

August 6, 2002

Bruce Rodger  
Wisconsin Department of Natural Resources  
101 S. Webster Street  
Madison, WI 53707-7921

Re: Mayville, Wisconsin Visibility Study  
Annual Report for the Period December 1, 2000 – December 31, 2001

Dear Bruce:

Enclosed are two (2) copies of the annual report for the period December 1, 2000 – December 31, 2001, for the Mayville Visibility Study, covered under purchase orders NMA00000673 (11/00 – 6/01) and NMB00000214 (7/01 – 6/02). I have also enclosed a CD containing final validated files of hourly nephelometer data and a PDF copy of the report.

Please contact me if you have any questions regarding the report or require any additional information.

Sincerely,

Heather Wayne  
Project Scientist

JPA/src  
Enclosures

**MAYVILLE WISCONSIN  
VISIBILITY STUDY  
ANNUAL REPORT**

Prepared for

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101 S. Webster Street  
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Prepared by

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August 6, 2002

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## **1.0 INTRODUCTION**

This report describes the Mayville Wisconsin air quality, meteorological, and visibility monitoring work completed December 1, 2000 – December 31, 2001, by Air Resource Specialists, Inc. (ARS) and Wisconsin Department of Natural Resources (DNR), under purchase orders NMA00000673 (11/00 – 6/01) and NMB00000214 (7/01 – 6/02).

ARS was responsible for collecting nephelometer (particle scattering), ambient temperature, relative humidity, wind speed, and wind direction data, validating the nephelometer, ambient temperature and relative humidity data, and providing the validated nephelometer, ambient temperature and relative humidity data to the Cooperative Institute for Research in the Atmosphere (CIRA) for upload to the Western Regional Air Partnership (WRAP) web site<sup>1</sup>. Wisconsin DNR was responsible for collecting ozone, PM<sub>2.5</sub>, ambient temperature, relative humidity, wind speed, wind direction, and solar radiation, validating all parameters, and uploading all parameters (with the exception of relative humidity) to the Environmental Protection Agency Air Quality System (EPA AQS) database. All work performed during the reporting period is described in this report and is organized into the following major sections:

- Section 1.0      Introduction
- Section 2.0      Site Specifications
- Section 3.0      Summary of Nephelometer Monitoring
- Section 4.0      Data Summaries and Statistics
  
- Appendix A      Meteorological Summary Statistics
- Appendix B      Timeline of Air Quality and Meteorological Data
- Appendix C      Scatter Plots – Air Quality Parameters
- Appendix D      Ozone Summary Data Products
- Appendix E      Nephelometer Summary Data Products
- Appendix F      Nephelometer Operational Time Lines
- Appendix G      PM2.5 Summary Data Products

Any questions or comments regarding this report should be addressed to:

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<sup>1</sup> <http://vista.cira.colostate.edu/wrap>

## **2.0 SITE SPECIFICATIONS**

The scope of the monitoring program includes the collection and reporting of optical, meteorological, and air quality data. Both ARS and Wisconsin DNR have data collection responsibilities at the Mayville, Wisconsin site. The nephelometer and relative humidity data presented in this report were collected and validated by ARS. The PM<sub>2.5</sub> TEOM, ozone, ambient temperature, wind speed, wind direction, and solar radiation data were collected and validated by Wisconsin DNR and represents the final data uploaded to the EPA AQS Database. Figure 2-1 presents a site location map.

Table 2-1 lists the parameters monitored and the equipment used at the Mayville, Wisconsin site, for the period December 1, 2000 – December 31, 2001. Wisconsin DNR personnel installed the Optec NGN-2 ambient nephelometer on November 28, 2000 and the Qualimetrics Novalynx model 240-150 solar radiation sensor in May 1, 2001. All other equipment was installed by Wisconsin DNR personnel prior to December 2000.

**Table 2-1**  
**Mayville, Wisconsin**  
**Monitored Parameters and Equipment**

<b>Parameters</b>	<b>Manufacturer/Model</b>	<b>Collected by ARS</b>	<b>Collected by WISC. DNR</b>	<b>Operational Period</b>
Particle Scattering	OPTEC NGN-2	X		12/01/2000 – 12/31/2001
Ozone	API 400A		X	12/01/2000 – 12/31/2001
PM2.5	Rupprecht & Patashnick 1400ab		X	12/01/2000 – 12/31/2001
Ambient Temperature	Rotronics MP101A	X	X	12/01/2000 – 12/31/2001
Relative Humidity	Rotronics MP101A	X	X	12/01/2000 – 12/31/2001
Wind Speed	Qualimetrics 2030	X	X	12/01/2000 – 12/31/2001
Wind Direction	Qualimetrics 2020	X	X	12/01/2000 – 12/31/2001
Solar Radiation	Qualimetrics 240-150		X	05/01/2001 – 12/31/2001

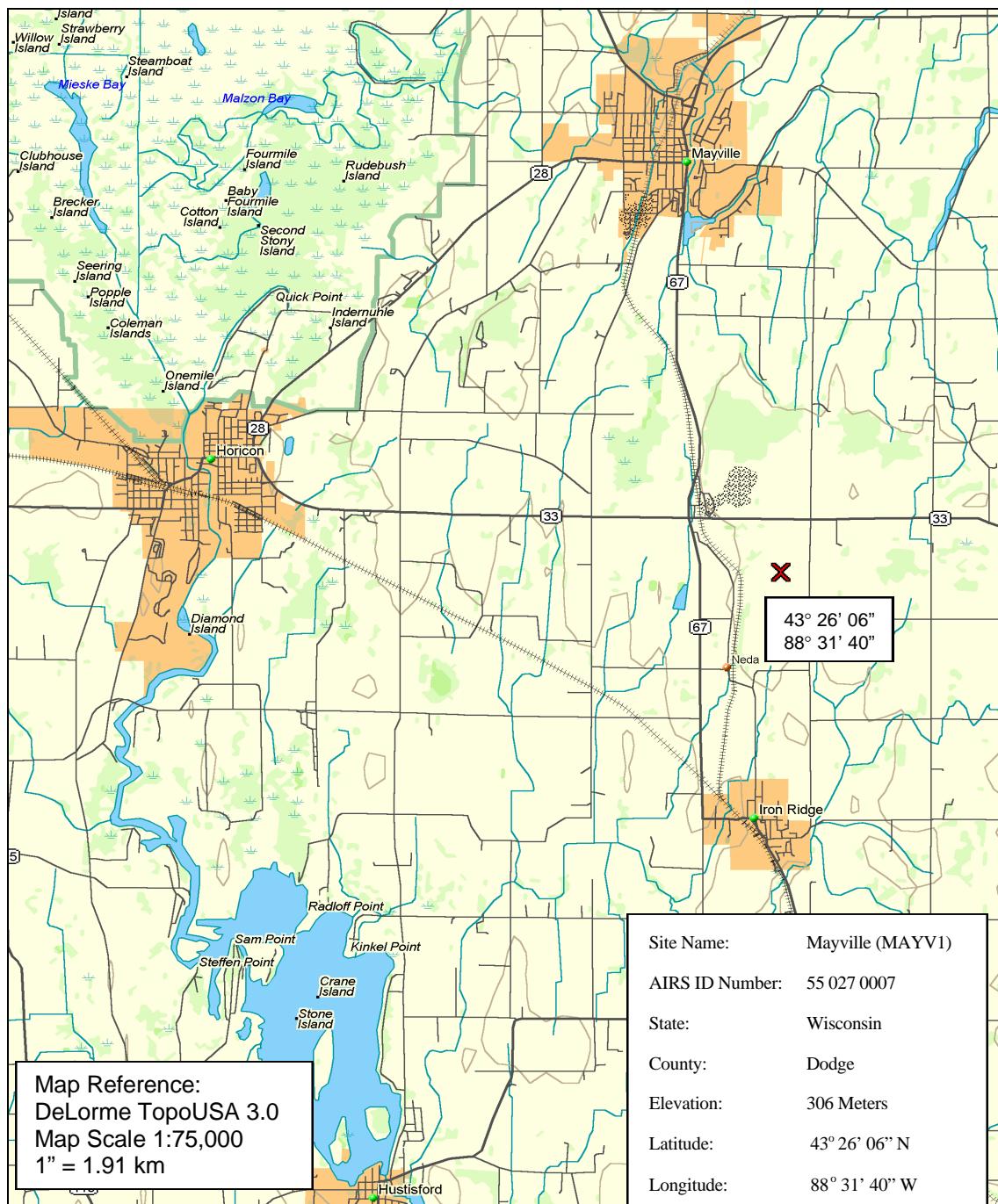


Figure 2-1. Mayville, Wisconsin, air quality monitoring location.

### **3.0 SUMMARY OF NEPHELOMETER MONITORING**

An ambient nephelometer collected continuous measurements of the ambient atmospheric particle scattering coefficient ( $b_{sp}$ ). An ambient temperature/relative humidity (AT/RH) sensor was collocated with the nephelometer for data validation and interpretation purposes. Data was collected with a datalogger and downloaded via telephone modem daily. The data were then validated in three stages according to IMPROVE protocol (Level-A, Level-0, and Level-1) as described below. Standard Operating Procedures (SOPs) and Technical Instructions (TIs) that fully describe the applied acquisition and reduction procedures include:

- SOP 4300 Collection of Optical Monitoring Data (IMPROVE Protocol)
- TI 4300-4002 Nephelometer Data Collection via Telephone Modem (IMPROVE Protocol)
- TI 4300-4006 Nephelometer Data Collection via Campbell Scientific Data Storage Module (IMPROVE Protocol)
- TI 4400-5010 Nephelometer Data Reduction and Validation (IMPROVE Protocol)

#### **3.1 NEPHELOMETER MONITORING SYSTEM**

- The nephelometer system was configured with the following instrumentation:
- Optec NGN-2 Ambient Nephelometer
- Rotronic MP-101A Air Temperature/Relative Humidity (AT/RH) sensor with motor aspirated shield
- Serial/Analog Data Acquisition System, including:
  - Campbell Scientific CR10 datalogger
  - Serial data interface
  - Solid state storage module (SM 192)
- Manual span gas system (SUVA 134a span gas, gas regulator, and supply hoses)
- Mounting tower and hardware

Sensor and sampling specifications are summarized in Table 3-1.

**Table 3-1**  
**NGN-2 Ambient Nephelometer and AT/RH Sensor**  
**Station Sensor and Sampling Specifications**  
**Mayville, Wisconsin**

<b>Parameter</b>	<b>Sensor</b>	<b>Units</b>	<b>Sample Frequency</b>	<b>Notes</b>
Nephelometer Raw readings	Optec NGN-2 Nephelometer	mVDC and Counts	2-minute average samples every 5 minutes	Optec NGN-2 Serial Output Logged
Nephelometer clean air calibration readings	Optec NGN-2 Nephelometer	mVDC and Counts	10-minute average at approximately 6-hour intervals	Start time drifts as controlled by Optec NGN-2 software
Nephelometer span calibrations (SUVA 134a)	Optec NGN-2 Nephelometer	mVDC and Counts	10-minute average performed manually at approximately 7-14 day intervals	Operator initiated during site visits
Nephelometer operating mode code	Optec NGN-2 Nephelometer	Unit less	1 code per nephelometer raw reading	Optec NGN-2 Serial Output Logged
Chamber temperature	Solid State Sensor	C	Concurrent with nephelometer reading	Available on serial data stream only
Ambient temperature	Rotronic MP-101A solid-state AT/RH	C (-30 to +50C)	Concurrent with nephelometer reading (5-minute averages of 10-second samples)	Sensor in forced air radiation shield
Ambient relative humidity	Rotronic MP-101A solid-state AT/RH	%RH (0 to 100%)	Concurrent with nephelometer reading (5-minute averages of 10-second samples)	Sensor in forced air radiation shield

## **3.2 ON-SITE DATALOGGING**

The CR10 datalogger collected and time-tagged the following data:

- Nephelometer RS232 serial data, including:
  - Status (ambient, clean air, span, lamp out, rain, chopper failure)
  - Raw scattered light value (counts)
  - Raw lamp brightness value (counts)
  - Normalized scattered light value (counts)
  - Integration time (minutes)
  - Chamber temperature (C)
  - Date: year - month - day (over range on the CR10)
  - Time: hour - minute (CST)
- Nephelometer analog data, including:
  - Analog line 1: normalized scattered light value (mV)
  - Analog line 2: status (mV)
- Ambient temperature (°C) - 5-minute averages of ten-second samples
- Relative humidity (%) - 5-minute averages of ten-second samples

The nephelometer was operated on Central Standard Time in a 5-minute cycled mode, as described in Table 3-1. Clean air calibrations were automatically performed at approximately 6-hour intervals. Manual clean air and span gas calibrations were performed at approximately 7-14 day intervals.

## **3.3 NEPHELOMETER DATA COLLECTION AND VALIDATION**

The three levels of IMPROVE protocol data validation are described in the following subsections.

### **3.3.1 Level-A Nephelometer Data Validation**

Raw nephelometer data collected daily from the site were reformatted and undergo Level-A validation. The procedures include:

- Nephelometer, ambient temperature, and relative humidity data are extracted from the raw data and appended to site-specific Level-A validated data files. Nephelometer and datalogger-generated status codes are appended along with the data. Data too large or too small to occupy the data fields in the Level-A data files are set to -99.

- Zero and span calibrations recorded by the datalogger are extracted from the raw data and entered into the QA calibration database. Calibration information is used during Level-1 validation.

Data at this point are at Level-A validation. Level-A data are visually reviewed daily to identify operational problems and initiate corrective procedures as soon as possible. Level-A validated data are plotted weekly, and comments regarding the operation of the nephelometer are noted on the plots. Data from operator log sheets are checked against data collected via telephone modem to identify inconsistencies and errors. Data from the log sheets are entered into the Quality Assurance (QA) Database.

### **3.3.2 Level-0 Nephelometer Data Validation**

Level-0 validation of nephelometer data was performed after all study data were collected. During Level-0 validation ARS staff scientists review Level-A data to identify periods of invalid data caused by the following:

- Burned out lamp
- Power failures
- Water contamination in nephelometer chamber
- Meteorological sensor failures (out of range values)
- Other problems

Periods identified as invalid are entered into the QA database.

### **3.3.3 Level-1 Nephelometer Data Validation**

Level-1 validation of nephelometer data are generated from Level-0 data, and includes:

- Conversion of raw nephelometer and meteorological data to engineering units
- Checks for out of range values
- Identification of nephelometer  $b_{sp}$  data affected by meteorology
- Estimation of uncertainty

Each of these steps is detailed below:

#### Conversion of Raw Nephelometer and Meteorological Data to Engineering Units

- Meteorological data (ambient temperature, relative humidity, and chamber temperature) are already in engineering units.
- The nephelometer scattering coefficient ( $b_{sp}$ ) is calculated by determining a calibration line for each data point, based on the interpolated current zero value and the difference between the original span and zero.

### Level-1 Range Checks

Level-1 5-minute and hourly average data are checked as follows:

- Data invalid at Level-0 is invalid at Level-1
- Calculated  $b_{scat}$  data ( $b_{sp}$  plus Rayleigh scattering) less than 80% Rayleigh scattering are invalid at Level-1 (Rayleigh scattering of  $11.064 \text{ Mm}^{-1}$ , based on elevation, was used at the Mayville site.)
- Meteorological data valid at Level-0 are valid at Level-1

### Identification of Nephelometer $b_{sp}$ Data Affected by Meteorology

Nephelometer measurements can be greatly influenced during periods of:

- Fog
- Heavy rain
- High relative humidity (> 90%)
- Blowing snow
- Other extreme meteorological conditions

Under these conditions nephelometer readings will no longer correspond to the optical properties of particulates in the atmosphere. Periods of meteorological interference identified during Level-1 are labeled "Weather Affected". Data not so labeled are called "Filtered". The following filters were used to identify these periods:

- Maximum: hourly  $b_{sp}$  data exceeding  $5000 \text{ Mm}^{-1}$  was coded as weather-affected.
- Relative Humidity: hourly  $b_{sp}$  data when the relative humidity exceeded 90% was coded as weather-affected.
- Rate of change: hourly  $b_{sp}$  data when the rate of change between consecutive hourly scattering values exceeded  $50 \text{ Mm}^{-1}$ , both values were coded as weather-affected.
- Standard deviation divided by the mean: hourly  $b_{sp}$  data when the standard deviation divided by the mean of the valid 5-minute scattering readings exceeded 10% was coded as weather-affected.

Figure 3-1 is a format key that summarizes a Level-1 validated nephelometer data file.

ARSADATA V5.0j: 08/03/2000 09-01-2000 05:09:36-----  
 LEVEL-0: 04-13-2001 17:22:42 NGN\_SEAS V6.0 04/09/2001 EXE DATE:04/10/2001 10:51-----  
 LEVEL-0: INPUT FILE: c:\Neph\_Reprocessing\Level\_A\More\_Level\_A\GRSM1\_N.003 09/12/2000 21:19-----  
 LEVEL-1: 04-13-2001 17:25:32 NGN\_SEAS V6.0 04/09/2001 EXE DATE:04/10/2001 10:51-----  
 LEVEL-1: Rayleigh= 10.636 Span Mult= 7.1 QA Search Flags:1 1-----  
 LEVEL-1: NEPHCOMMON LIBRARY VERSION:04/09/2001-----  
 LEVEL-1: INPUT FILE: c:\Neph\_Reprocessing\Level\_0\FINAL\_LEVEL\_0\More\_FINAL\_LEVEL\_0\GRSM1\_N.003 04/13/2001 17:25-----

SITE	YEARMMDD	JD	HHMM	INS	BSP	PREC	V	A	RAW-M	RAW-SD	#	N/A	SD/M	DEL	MAX	RH	0123456789mPMOT	YINTER	SLOPE	AT	AT-SD	#	AT-PR	CT	CT-SD	#	CT-PR	RH	RH-SD	#	RH-PR	N/A
GRSM1	20000601	153	0000	025	58	0.150	0		238.84	7.10	11	-99.0	10.0	50	5000	90	0B1000000000012	-154.0	0.93	20.18	0.35	12	1.00	20.15	0.32	10	1.00	75.35	1.99	12	2.00XXXX	
GRSM1	20000601	153	0100	025	64	0.150	0		245.45	3.36	11	-99.0	10.0	50	5000	90	0B1000000000011	-154.7	0.93	19.59	0.25	12	1.00	19.81	0.26	11	1.00	78.02	1.29	12	2.00XXXX	
GRSM1	20000601	153	0200	025	58	0.150	0		239.87	5.27	12	-99.0	10.0	50	5000	90	0C0000000000000	-154.9	0.93	19.58	0.37	12	1.00	19.59	0.25	12	1.00	77.39	2.31	12	2.00XXXX	
GRSM1	20000601	153	0300	025	59	0.150	0		240.88	11.88	12	-99.0	10.0	50	5000	90	0C0000000000000	-155.2	0.93	19.44	0.65	12	1.00	19.73	0.43	12	1.00	78.33	4.10	12	2.00XXXX	
GRSM1	20000601	153	0400	025	55	0.150	0		236.96	7.97	12	-99.0	10.0	50	5000	90	0C0000000000000	-155.4	0.93	19.16	0.38	12	1.00	19.20	0.26	12	1.00	78.90	2.43	12	2.00XXXX	
GRSM1	20000601	153	0500	025	54	0.150	0		235.65	1.57	12	-99.0	10.0	50	5000	90	0C0000000000000	-155.7	0.93	19.42	0.10	12	1.00	19.47	0.08	12	1.00	77.63	0.47	12	2.00XXXX	
GRSM1	20000601	153	0600	025	53	0.150	0		235.24	3.15	12	-99.0	10.0	50	5000	90	0C0000000000000	-155.9	0.93	19.96	0.37	12	1.00	20.28	0.49	12	1.00	76.43	1.02	12	2.00XXXX	
GRSM1	20000601	153	0700	025	53	0.150	0		235.33	2.39	10	-99.0	10.0	50	5000	90	0A2000000000023	-156.1	0.93	21.56	0.52	12	1.00	21.88	0.35	9	1.00	72.19	0.91	12	2.00XXXX	
GRSM1	20000601	153	0800	025	54	0.150	0		236.68	3.25	12	-99.0	10.0	50	5000	90	0C0000000000000	-156.0	0.93	22.36	0.18	12	1.00	22.14	0.08	12	1.00	71.68	0.96	12	2.00XXXX	
GRSM1	20000601	153	0900	025	53	0.150	0		234.82	6.44	12	-99.0	10.0	50	5000	90	0C0000000000000	-155.7	0.93	22.73	0.40	12	1.00	22.16	0.22	12	1.00	72.21	2.60	12	2.00XXXX	

Field	Description
SITE	Site Abbreviation
YYYYMMDD	Date (4-digit year/month/day)
JD	Julian Date
HHMM	Time using a 24-hour clock in hour/minute format
INS	Nephelometer Serial Number
BSP	$b_{sp}$ ( $Mm^{-1}$ )
PREC	$b_{sp}$ Estimated Precision (%/100)
V	$b_{sp}$ Validity Code (0 = valid, 1 = interference, 2 = invalid, 9 = suspect)
A	$b_{sp}$ Interference Code <sup>1</sup>
RAW-M	Raw Nephelometer Hourly Average (Counts)
RAW-SD	Standard Deviation of Raw Nephelometer Average (Counts)
#	Number of Data Points in Hourly Nephelometer Average (Not Used)
N/A	Standard Deviation/Mean Interference Threshold
SD/M	$b_{sp}$ Rate of Change Interference Threshold
DEL	Maximum $b_{sp}$ Interference Threshold
MAX	Relative Humidity Interference Threshold
RH	Composite Nephelometer Code Summary <sup>2</sup>
0123456789mPMOT	Y-intercept of Calibration Line Used to Calculate $b_{sp}$
YINTER	Slope of Calibration Line Used to Calculate $b_{sp}$
SLOPE	Average Ambient Temperature (°C)
AT	Standard Deviation of Hourly AT Average
AT-SD	Number of Data Points in Hourly AT Average
#	Estimated Precision of Ambient Temperature
AT-PR	Average Nephelometer Chamber Temperature (°C)
CT	Standard Deviation of Hourly CT Average
CD-SD	Number of Data Points in Hourly CT Average
#	Estimated Precision of Chamber Temperature
CT-PR	Average Relative Humidity (%)
RH	Standard Deviation of Hourly RH Average
RH-SD	Number of Data Points in Hourly RH Average
#	Estimated Precision of Relative Humidity
RH-PR	(Not Used)
N/A	

#### <sup>1</sup> $b_{sp}$ Interference Code:

Condition	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
RH > RH threshold	x		x		x		x		x		x		x		x
$b_{sp}$ > maximum $b_{sp}$ threshold	x	x		x	x		x	x		x	x		x	x	
SD/M > uncertainty threshold	x	x	x	x	x				x	x	x	x			
$\Delta b_{sp}$ > delta threshold	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Z Weather observation between two other weather observations.

Threshold values may be different for each site.

#### <sup>2</sup>Composite Nephelometer Code Summary:

0123456789	Nephelometer diagnostic code (internal use)
m	Number of missing data points
P	Number of power failure codes
M	Number of manual QA invalidation codes
O	Number of Level-0 invalidated data points
T	Number of times non-serial data were used

Figure 3-1. Level-1 Validated Nephelometer Data File Format Key.

### Nephelometer Measurement Uncertainty

The measurement uncertainty of the Optec NGN-2 ambient nephelometer is calculated from the distribution of calibration slopes determined during manual span/zero calibrations. The reported uncertainty is the 95% confidence limit of a two-tailed t-distribution.

Important elements of Optec NGN-2 nephelometer calibration are:

- The nephelometer output consists of unit less values (counts).
- The nephelometer has no adjustable parameters.
- The unit less clean air (zero) and SUVA 134a (span) calibration values correspond to nephelometer-detector response to scattering by Rayleigh air and SUVA 134a, respectively.
- After a period of time, the nephelometer chamber will tend to accumulate dust and other matter, increasing the background scattering. The value (in counts) of clean air and SUVA 134a calibrations, therefore, will increase over time.
- Rayleigh scattering of air is a function of temperature and pressure, but can be reasonable approximated based on site altitude.
- The scattering for SUVA 134a is assumed to be equal to 7.1 times that of Rayleigh air.

The overall uncertainty for the nephelometer from 11/28/2000 through 10/19/2001 was 17%. The nephelometer was removed for servicing on 10/19/2001 and reinstalled on 11/14/2001. The uncertainty for the nephelometer from 11/14/2001 through 12/31/2001 was 18%.

### Air Temperature/Relative Humidity Sensor Uncertainty

The AT/RH sensor collocated with the nephelometer was calibrated prior to installation and shown to perform within the manufacturer's specifications during the reporting period.

## **4.0 DATA SUMMARIES AND STATISTICS**

### **4.1 DATA DELIVERABLES**

A CD containing final validated files of hourly nephelometer data are delivered with this report.

### **4.2 DATA RECOVERY STATISTICS**

Data validation statistics for the monitoring period are summarized by parameter in Table 4-1. Missing/Invalid data codes were not provided when the data was uploaded from Wisconsin DNR files to the EPA AQS database. Therefore, data collection statistics are not provided in this report.

**Table 4-1**

**Data Validation Statistics  
Mayville, Wisconsin  
December 1, 2000 – December 31, 2001**

Parameter	Interval	No. Possible	No. Valid	% Valid
Ozone	hourly	9504	9351	98.4
PM2.5 TEOM	hourly	9504	9363	98.5
Relative Humidity	hourly	9504	9373	98.6
Solar Radiation	hourly	5880	5877	99.9
Scalar Wind Direction	hourly	9504	9396	98.9
Scalar Wind Speed	hourly	9504	9496	99.9
Ambient Temperature	hourly	9504	8692	91.5
Nephelometer Bsp	hourly	9504	5421	57.0

### **4.3 METEOROLOGICAL SUMMARY STATISTICS**

Meteorological summary statistics for the reporting period are summarized by parameter in Appendix A.

Wind roses for the reporting period can also be found in Appendix A. Note that the wind roses in this report vary slightly from the wind roses that were presented in the Mayville Visibility Study preliminary reports. This variation is due to differing data validation techniques between ARS and Wisconsin DNR. Wisconsin DNR data validation protocol is, if the winds speed falls below 3mph the wind speed and wind direction are set equal to 0 to denote calm conditions.

### **4.4 TIMELINE OF AIR QUALITY AND METEOROLOGICAL DATA**

Timeline plots of final validated air quality and meteorological data are provided in Appendix B. Note that the particle scattering (Bsp) that is plotted in the timeline plots is filtered data.

### **4.5 RELATIONSHIP BETWEEN AIR QUALITY PARAMETERS**

Scatter plots summarizing the relationship between air quality parameters can be found in Appendix C.

A direct relationship between particle light scattering (Bsp) and total PM<sub>2.5</sub> is not possible to determine because different components of the PM<sub>2.5</sub> have different light scattering efficiencies, and the Bsp is measured in ambient RH conditions, but the PM<sub>2.5</sub> is determined under fairly dry conditions. The scatter plots in Figures C-1 and C-2 show a variable relationship which depends on the season. This variability is likely due in part to periods of higher sustained relative humidity in the 1<sup>st</sup> and 4<sup>th</sup> quarters. The R<sup>2</sup> between PM<sub>2.5</sub> and light scattering is shown to range from 0.50 to 0.70.

The relationship between ozone and PM2.5 is illustrated in Figures C-3 through C-4. There is a weak correlation between ozone and PM2.5, during the 2<sup>nd</sup> and 3<sup>rd</sup> quarters ( $R^2 = 0.21, 0.29$ ) and essentially no correlation during the 1<sup>st</sup> and 4<sup>th</sup> quarters ( $R^2 = 0.1, 0.0$ ).

## **4.6 OZONE DATA**

The following data products summarize the ozone data collected during the reporting period, December 1, 2000 – December 31, 2001 and can be found in Appendix D:

- 10 Highest Daily 1-Hour Average Maximum Concentration Tables;
- Pollutant roses;
- Monthly bar charts illustrating the highest hourly average, highest 8-hour average and the monthly average; and
- Diurnal plots.

## **4.7 NEPHELOMETER DATA**

The following data products summarize the ambient nephelometer data collected during the reporting period, December 1, 2000 – December 31, 2001 and can be found in Appendix E:

- Quarterly Data Summaries showing 4- and 24-hour average particle scattering; and
- Diurnal plots.

Operational Timelines for the nephelometer that were provided in the preliminary reports can be found in Appendix F.

## **4.8 PM<sub>2.5</sub> DATA**

The following data products summarize the PM<sub>2.5</sub> TEOM data collected during the reporting period, December 1, 2000 – December 31, 2001 and can be found in Appendix G:

- 10 Highest Daily 1-Hour Average Maximum Concentration Tables;
- Pollutant roses;
- Monthly bar charts illustrating the highest and second highest hourly average, highest 24-hour average and the monthly average; and
- Diurnal plots.

## **APPENDIX A**

### **METEOROLOGICAL SUMMARY STATISTICS**

## Summary of Selected Meteorological Data

### Mayville Visibility Study

#### Final Validation

12/01/2000 - 12/31/2000

Parameter	Value	Units	Number	Std Dev
SCALAR WIND SPEED				
Average	4.4	m/s	744	1.9
Maximum	11.7	m/s		
Percent calm = 2.28				
AMBIENT TEMPERATURE				
Average	-11.1	degC	625	5.9
Maximum	4.0	degC		
Minimum	-24.2	degC		
RELATIVE HUMIDITY				
Average	81	percent	626	8
Maximum	100	percent		
Minimum	57	percent		
PRECIPITATION (Rainfall or Snow melt)				
Average non-zero rate	NA			
Maximum non-zero rate				
Minimum non-zero rate				
Accumulated during period				
SOLAR RADIATION				
Average Daily Total	NA			
Maximum Daily Total				
Minimum Daily Total				

Note: Calms are included in the average scalar wind speed and are defined as winds less than 0.5 m/s (1.0 mph).

Solar radiation terms are based on the calculation of the total amount of solar energy incident on a unit area during each day. The maximum and minimum daily totals are selected from the list of daily totals. The totals for all days are then added and divided by the number of days to yield the average daily total. Only days with 24 valid values are included in these statistics.

NA indicates instrument not available.

## Summary of Selected Meteorological Data

### Mayville Visibility Study

#### Final Validation

01/01/2001 - 03/31/2001

Parameter	Value	Units	Number	Std Dev
SCALAR WIND SPEED				
Average	4.5	m/s	2157	2.0
Maximum	13.7	m/s		
Percent calm = 1.58				
AMBIENT TEMPERATURE				
Average	-3.8	degC	1485	5.2
Maximum	9.1	degC		
Minimum	-17.2	degC		
RELATIVE HUMIDITY				
Average	78	percent	2160	14
Maximum	100	percent		
Minimum	26	percent		
PRECIPITATION (Rainfall or Snow melt)				
Average non-zero rate	NA			
Maximum non-zero rate				
Minimum non-zero rate				
Accumulated during period				
SOLAR RADIATION				
Average Daily Total	NA			
Maximum Daily Total				
Minimum Daily Total				

Note: Calms are included in the average scalar wind speed and are defined as winds less than 0.5 m/s (1.0 mph).

Solar radiation terms are based on the calculation of the total amount of solar energy incident on a unit area during each day. The maximum and minimum daily totals are selected from the list of daily totals. The totals for all days are then added and divided by the number of days to yield the average daily total. Only days with 24 valid values are included in these statistics.

NA indicates instrument not available.

## Summary of Selected Meteorological Data

### Mayville Visibility Study

#### Final Validation

04/01/2001 - 06/30/2001

Parameter	Value	Units	Number	Std Dev
SCALAR WIND SPEED				
Average	4.3	m/s	2180	2.3
Maximum	17.0	m/s		
Percent calm = 2.20				
AMBIENT TEMPERATURE				
Average	13.7	degC	2182	6.9
Maximum	29.6	degC		
Minimum	-4.0	degC		
RELATIVE HUMIDITY				
Average	70	percent	2183	19
Maximum	100	percent		
Minimum	28	percent		
PRECIPITATION (Rainfall or Snow melt)				
Average non-zero rate	NA			
Maximum non-zero rate				
Minimum non-zero rate				
Accumulated during period				
SOLAR RADIATION				
Average Daily Total	442.851	ly/day	61	171.248
Maximum Daily Total	666.600	ly/day		
Minimum Daily Total	132.600	ly/day		

Note: Calms are included in the average scalar wind speed and are defined as winds less than 0.5 m/s (1.0 mph).

Solar radiation terms are based on the calculation of the total amount of solar energy incident on a unit area during each day. The maximum and minimum daily totals are selected from the list of daily totals. The totals for all days are then added and divided by the number of days to yield the average daily total. Only days with 24 valid values are included in these statistics.

NA indicates instrument not available.

## Summary of Selected Meteorological Data

### Mayville Visibility Study

#### Final Validation

07/01/2001 - 09/30/2001

Parameter	Value	Units	Number	Std Dev
SCALAR WIND SPEED				
Average	3.2	m/s	2207	1.5
Maximum	8.7	m/s		
Percent calm = 3.44				
AMBIENT TEMPERATURE				
Average	19.0	degC	2201	5.7
Maximum	33.0	degC		
Minimum	1.2	degC		
RELATIVE HUMIDITY				
Average	75	percent	2203	17
Maximum	101	percent		
Minimum	26	percent		
PRECIPITATION (Rainfall or Snow melt)				
Average non-zero rate	NA			
Maximum non-zero rate				
Minimum non-zero rate				
Accumulated during period				
SOLAR RADIATION				
Average Daily Total	423.073	ly/day	92	159.800
Maximum Daily Total	688.800	ly/day		
Minimum Daily Total	45.600	ly/day		

Note: Calms are included in the average scalar wind speed and are defined as winds less than 0.5 m/s (1.0 mph).

Solar radiation terms are based on the calculation of the total amount of solar energy incident on a unit area during each day. The maximum and minimum daily totals are selected from the list of daily totals. The totals for all days are then added and divided by the number of days to yield the average daily total. Only days with 24 valid values are included in these statistics.

NA indicates instrument not available.

## Summary of Selected Meteorological Data

### Mayville Visibility Study

#### Final Validation

10/01/2001 - 12/31/2001

Parameter	Value	Units	Number	Std Dev
SCALAR WIND SPEED				
Average	4.9	m/s	2208	2.2
Maximum	13.0	m/s		
Percent calm = 0.91				
AMBIENT TEMPERATURE				
Average	4.6	degC	2199	7.4
Maximum	24.8	degC		
Minimum	-16.8	degC		
RELATIVE HUMIDITY				
Average	77	percent	2201	18
Maximum	101	percent		
Minimum	25	percent		
PRECIPITATION (Rainfall or Snow melt)				
Average non-zero rate	NA			
Maximum non-zero rate				
Minimum non-zero rate				
Accumulated during period				
SOLAR RADIATION				
Average Daily Total	137.309	ly/day	92	80.397
Maximum Daily Total	349.800	ly/day		
Minimum Daily Total	16.200	ly/day		

Note: Calms are included in the average scalar wind speed and are defined as winds less than 0.5 m/s (1.0 mph).

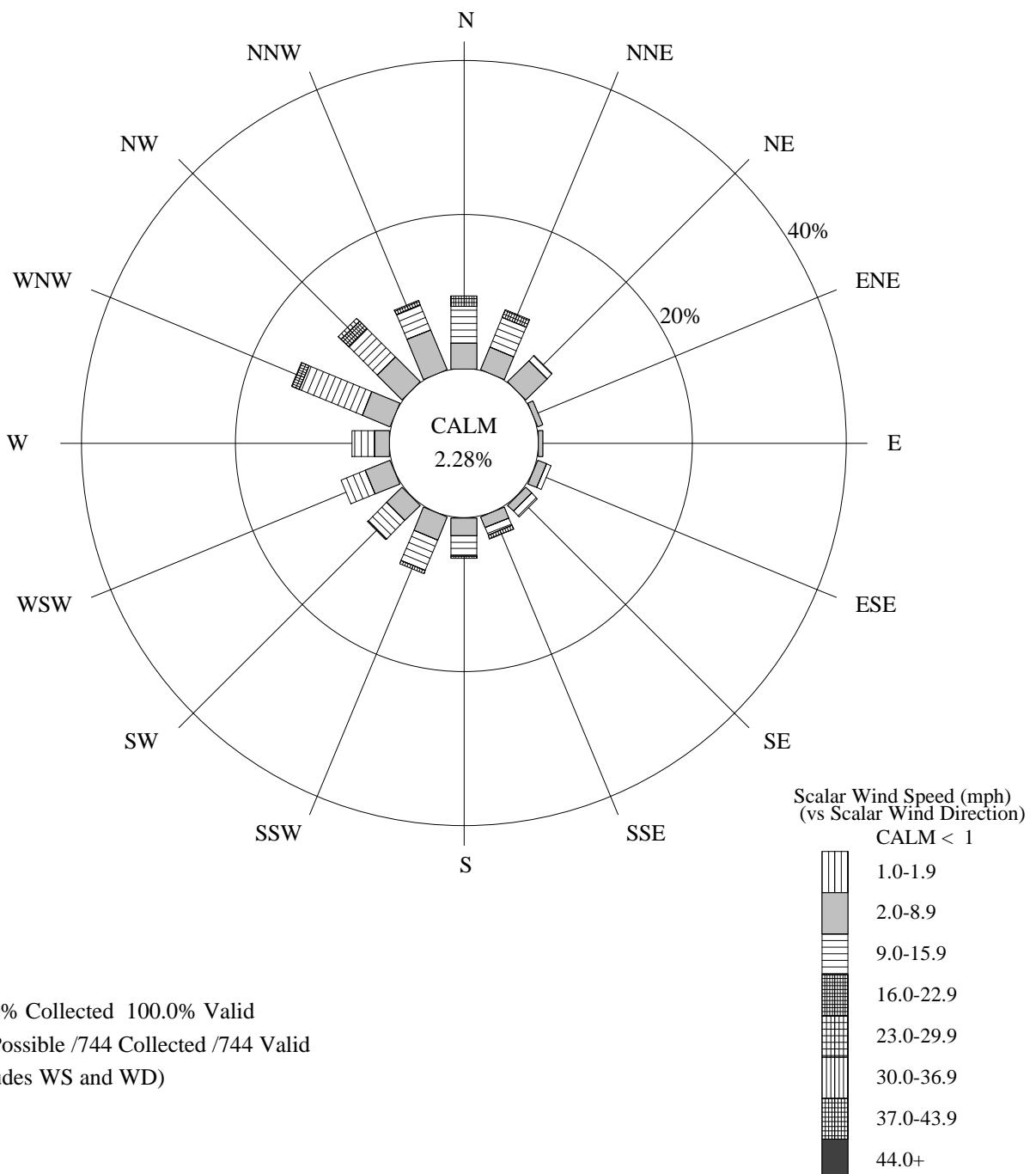
Solar radiation terms are based on the calculation of the total amount of solar energy incident on a unit area during each day. The maximum and minimum daily totals are selected from the list of daily totals. The totals for all days are then added and divided by the number of days to yield the average daily total. Only days with 24 valid values are included in these statistics.

NA indicates instrument not available.

Mayville Visibility Study

Wind Rose

12/01/2000 - 12/31/2000

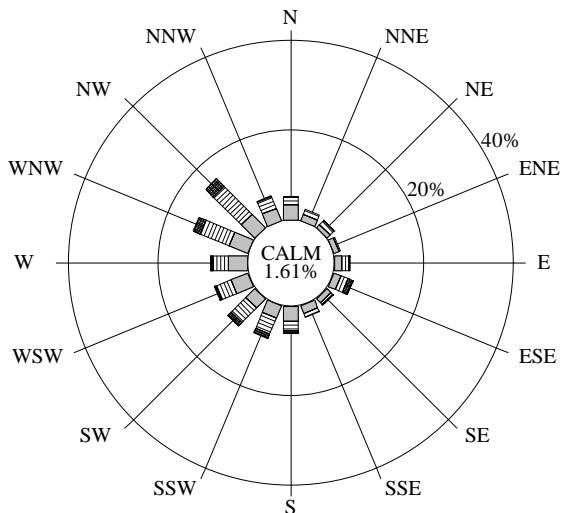


# Mayville Visibility Study

# Quarterly Wind Rose

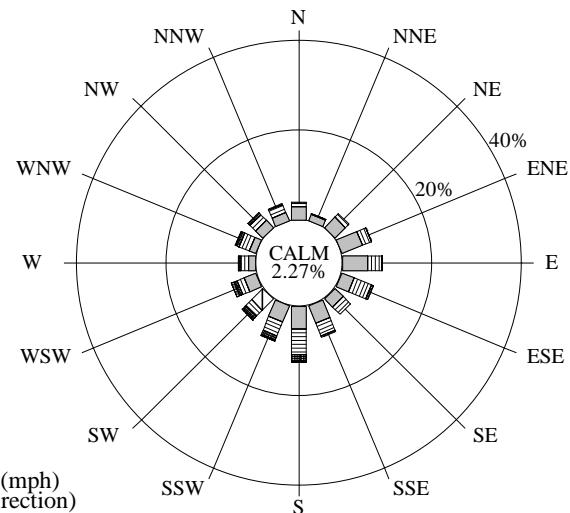
2001

FIRST QUARTER (JAN-MAR)

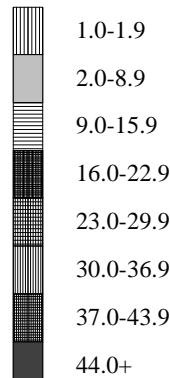


98.1% Collected 98.1% Valid  
2160 Possible /2118 Collected /2118 Valid  
(includes WS and WD)

SECOND QUARTER (APR-JUN)

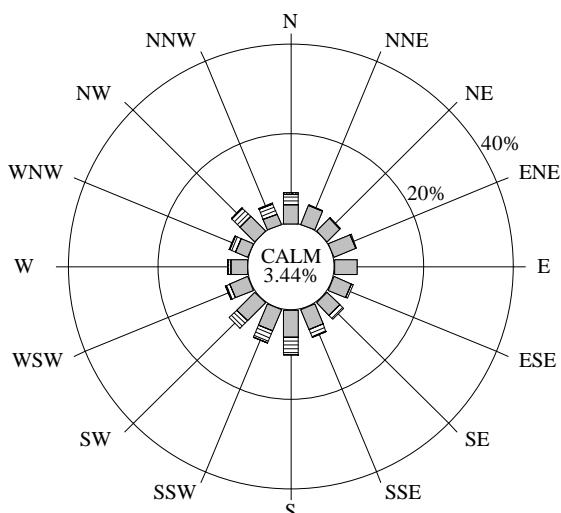


Scalar Wind Speed (mph)  
(vs Scalar Wind Direction)  
CALM < 1



97.0% Collected 97.0% Valid  
2184 Possible /2119 Collected /2119 Valid  
(includes WS and WD)

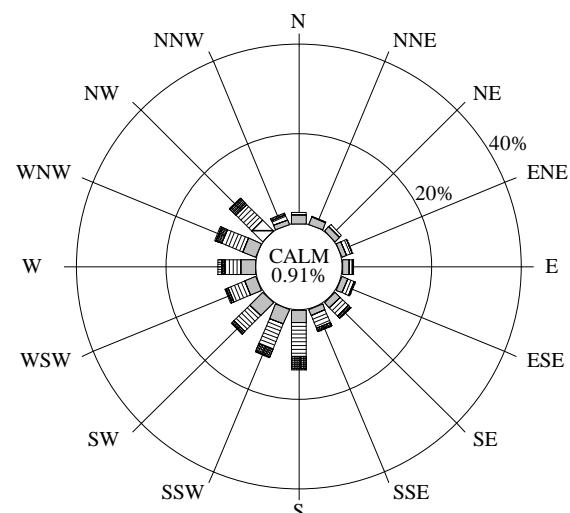
THIRD QUARTER (JUL-SEP)



100.0% Collected 100.0% Valid  
2208 Possible /2207 Collected /2207 Valid  
(includes WS and WD)

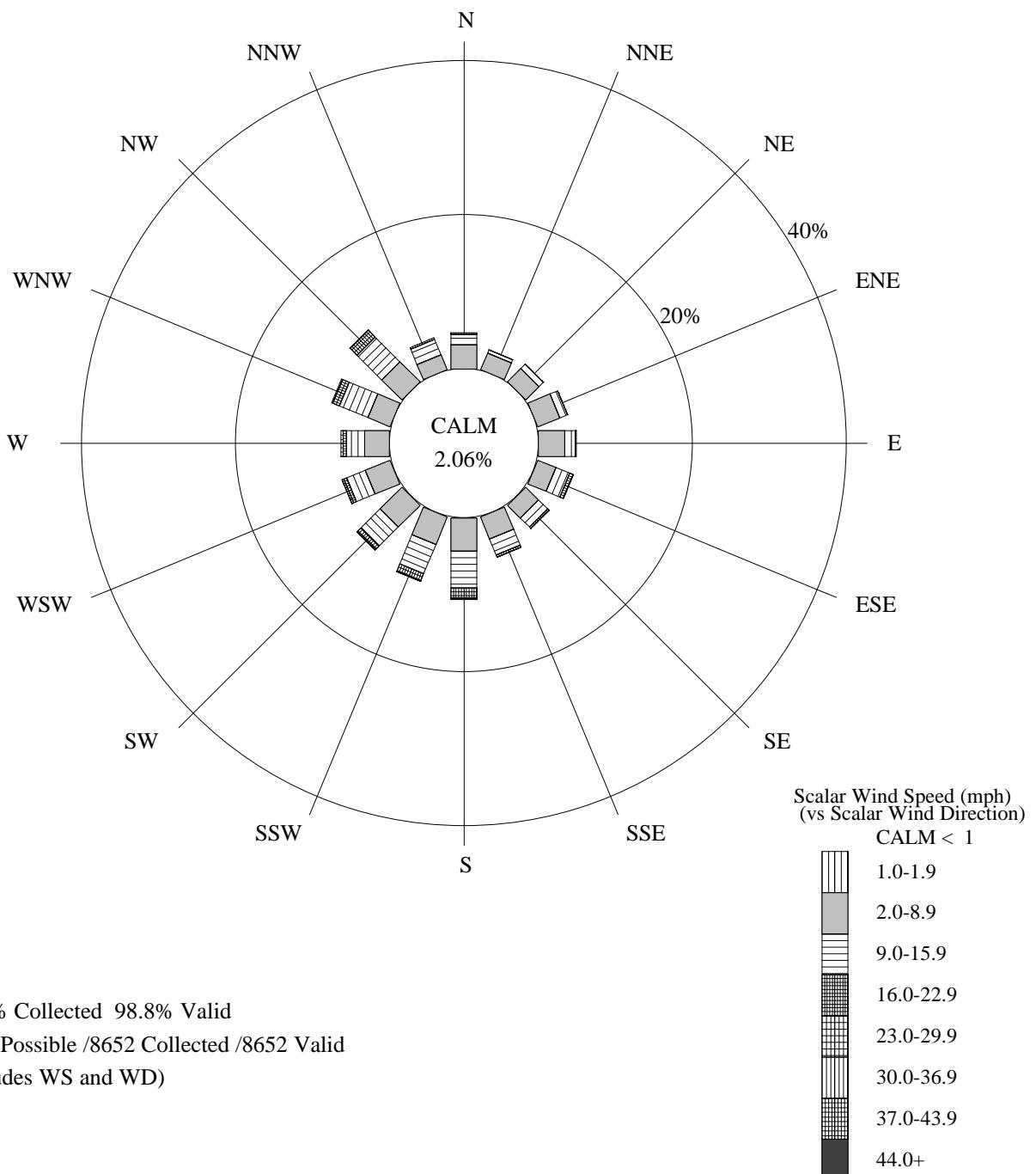
Final Validation

FOURTH QUARTER (OCT-DEC)



100.0% Collected 100.0% Valid  
2208 Possible /2208 Collected /2208 Valid  
(includes WS and WD)

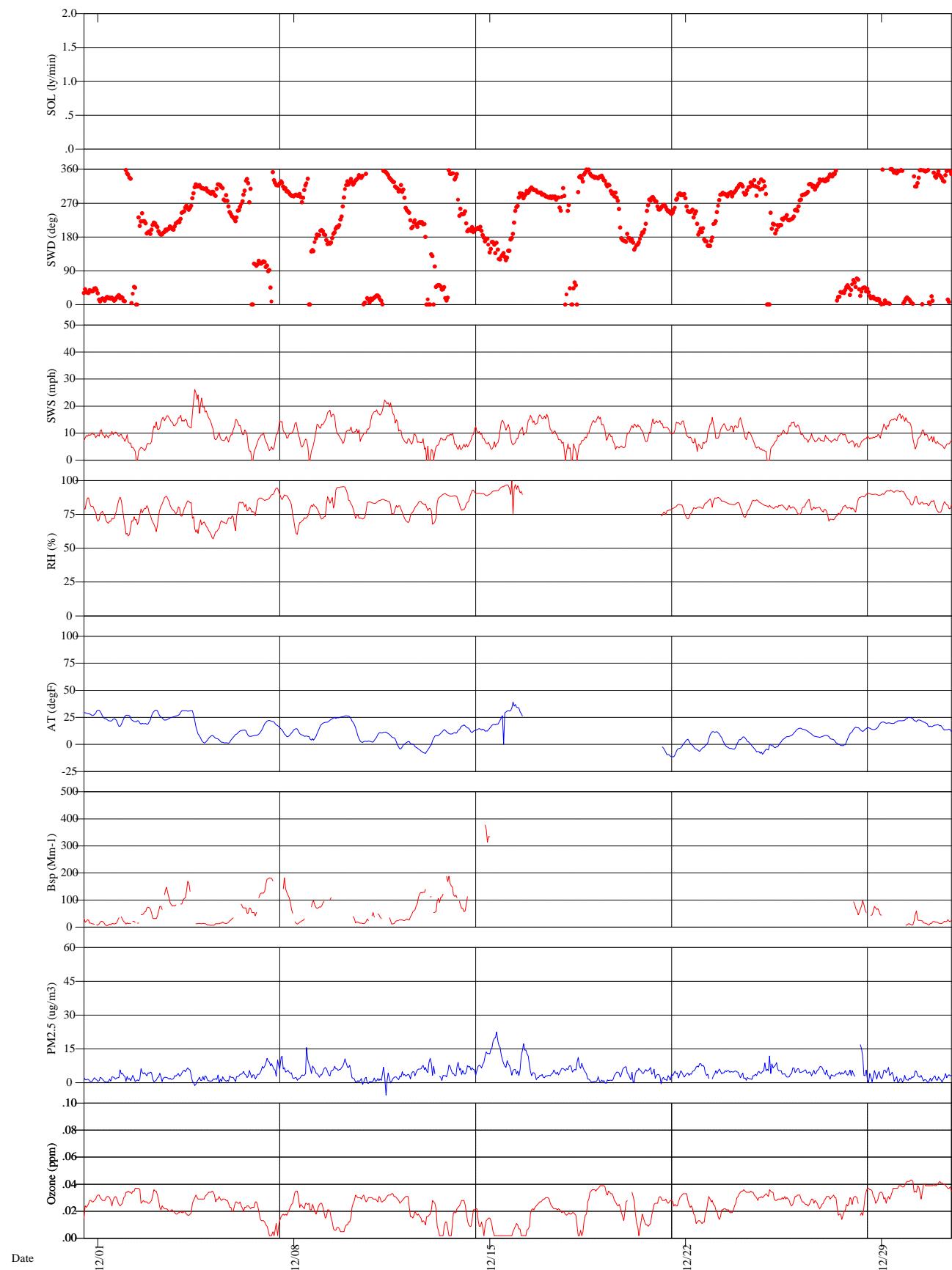
07-15-2002



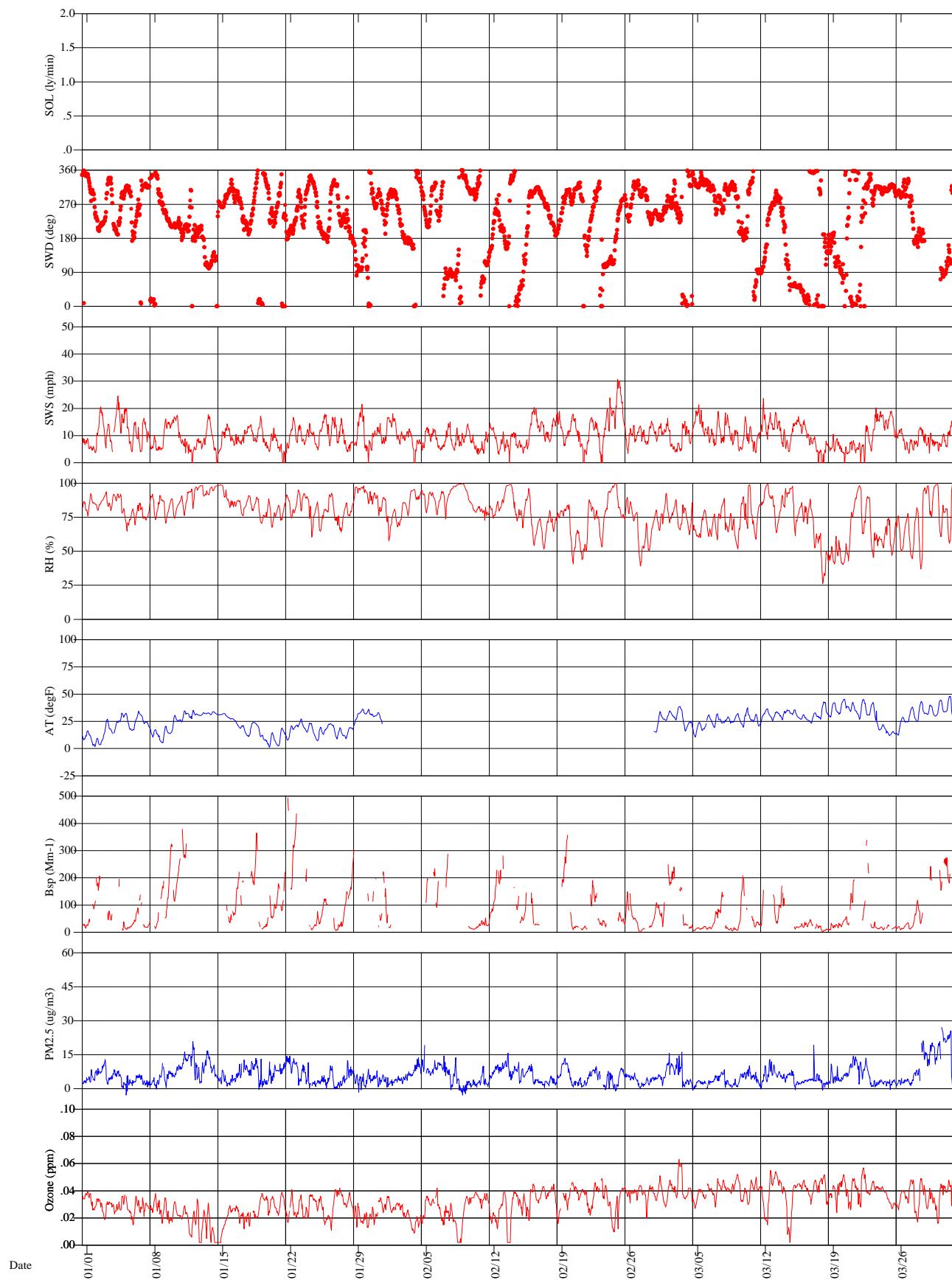
## **APPENDIX B**

### **TIMELINE OF AIR QUALITY AND METEOROLOGICAL DATA**

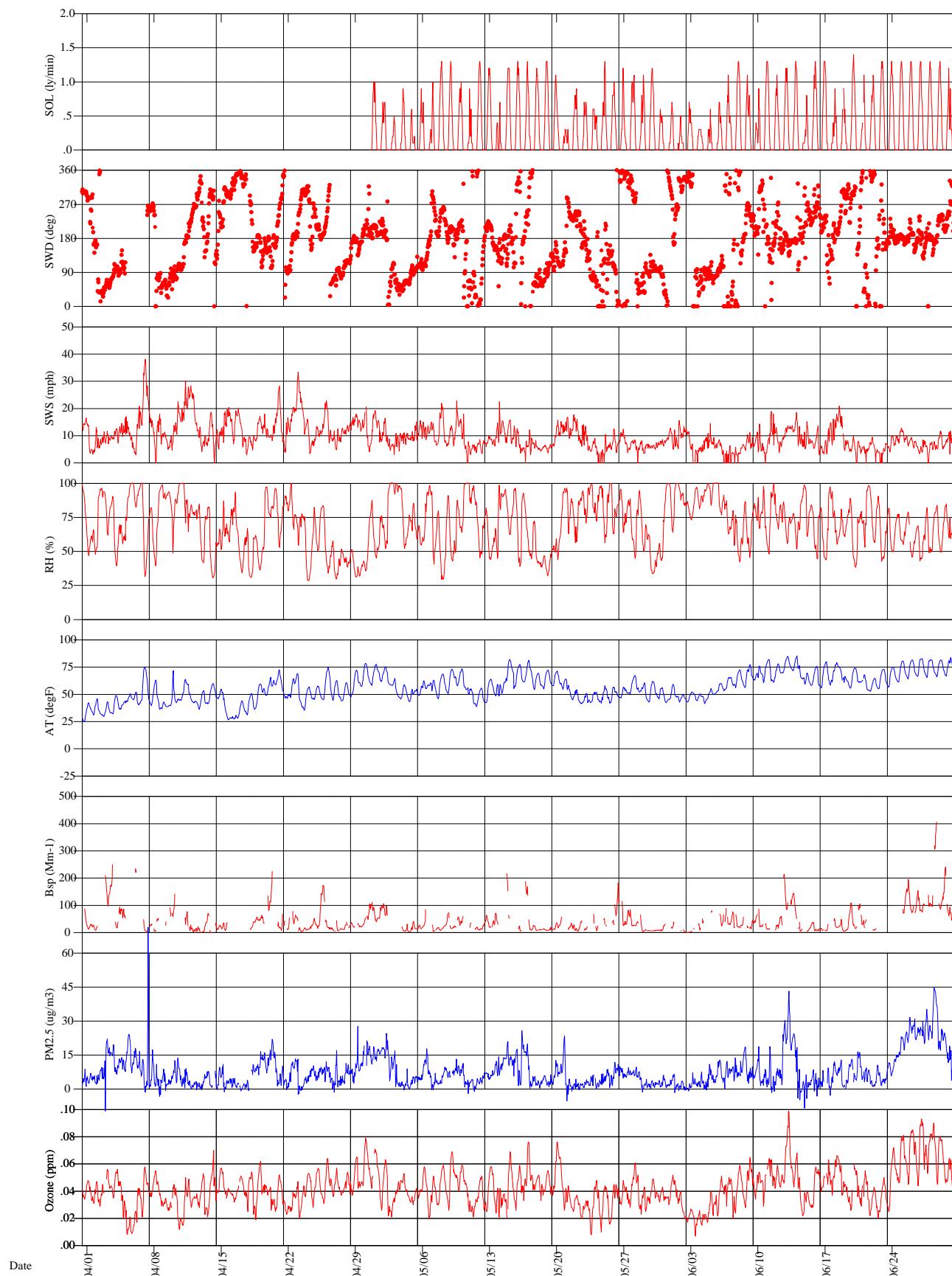
### Mayville, Wisconsin



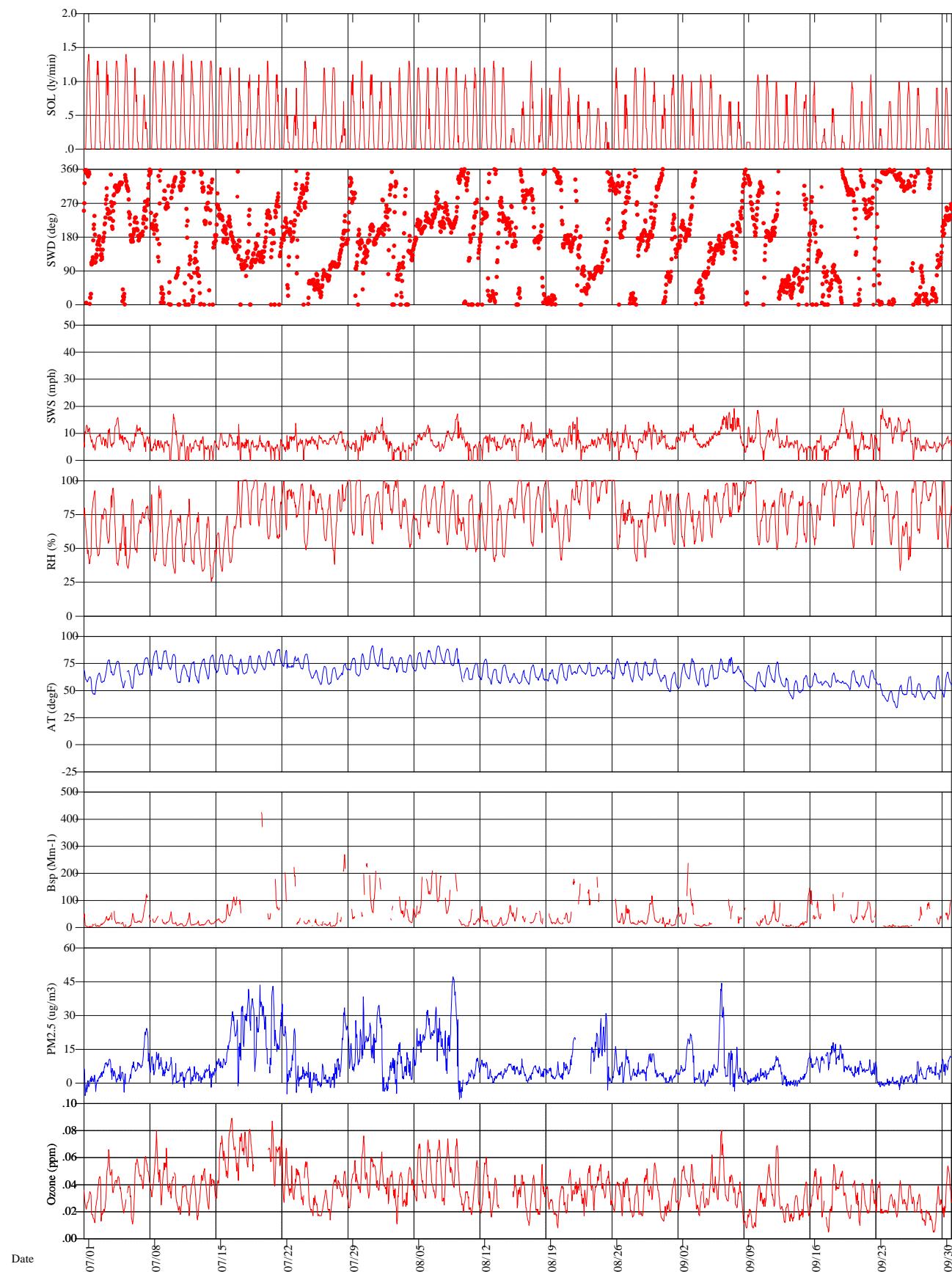
### Mayville, Wisconsin



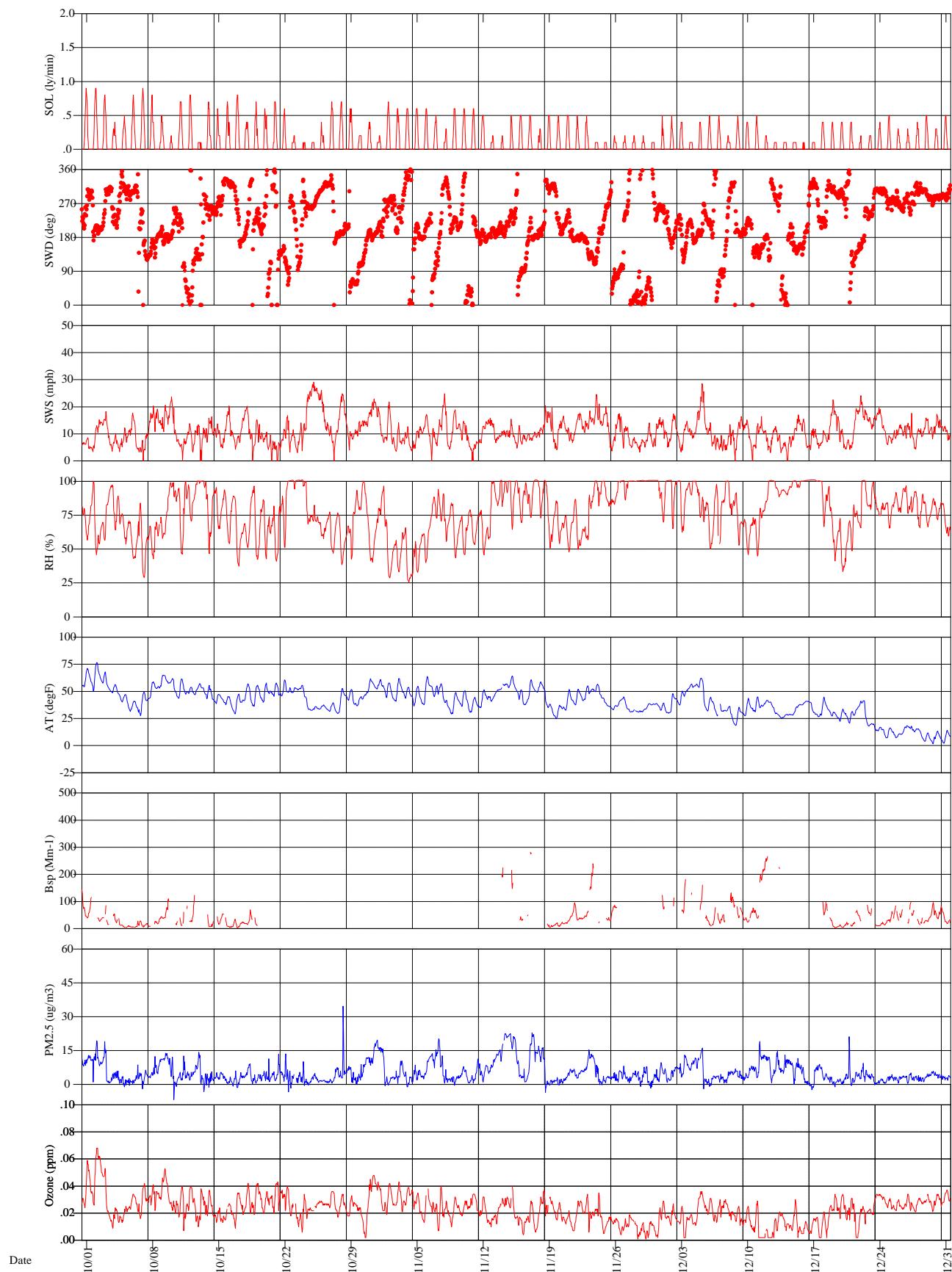
### Mayville, Wisconsin



### Mayville, Wisconsin



### Mayville, Wisconsin



**APPENDIX C**

**SCATTER PLOTS**  
**AIR QUALITY PARAMETERS**

Mayville Visibility Study

Figure C-1  
Scatter Plot  
Light Scattering (Bsp) VS. PM2.5

12/01/2000 - 12/31/2000

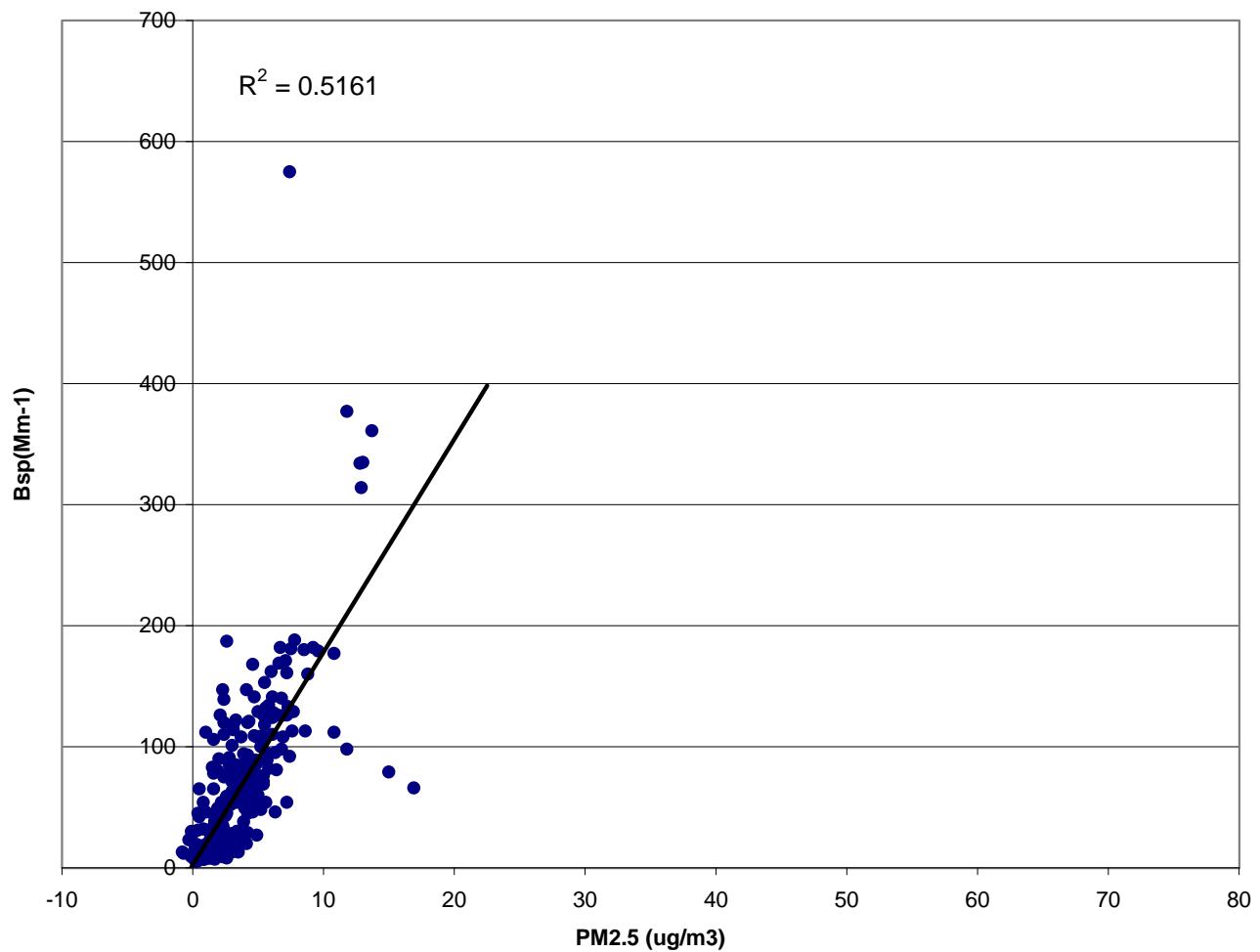
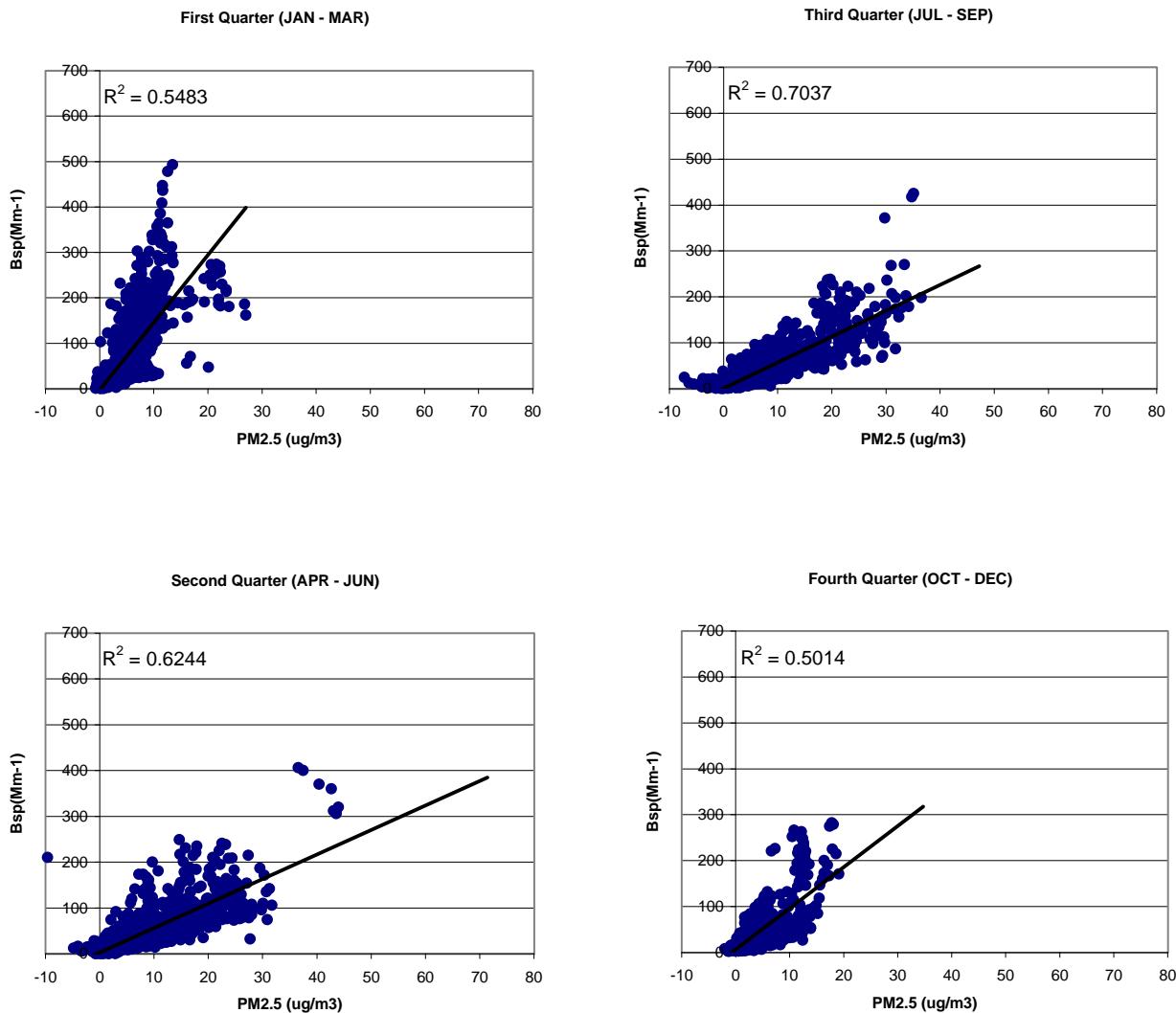


Figure C-2  
Quarterly Scatter Plots  
Light Scattering (Bsp) VS. PM2.5

2001



Mayville Visibility Study

Figure C-3  
Scatter Plot  
Ozone VS. PM2.5

12/01/2000 - 12/31/2000

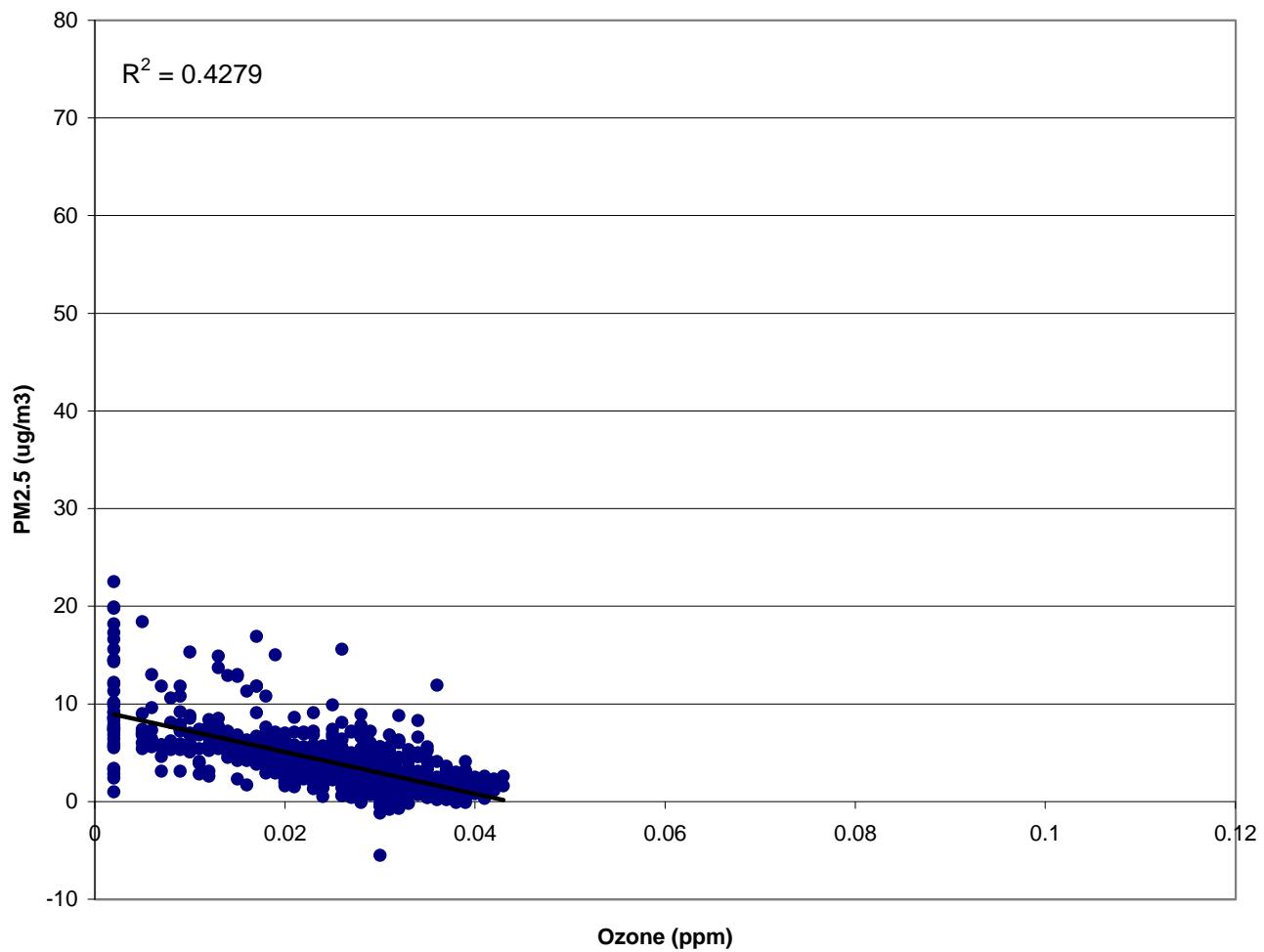
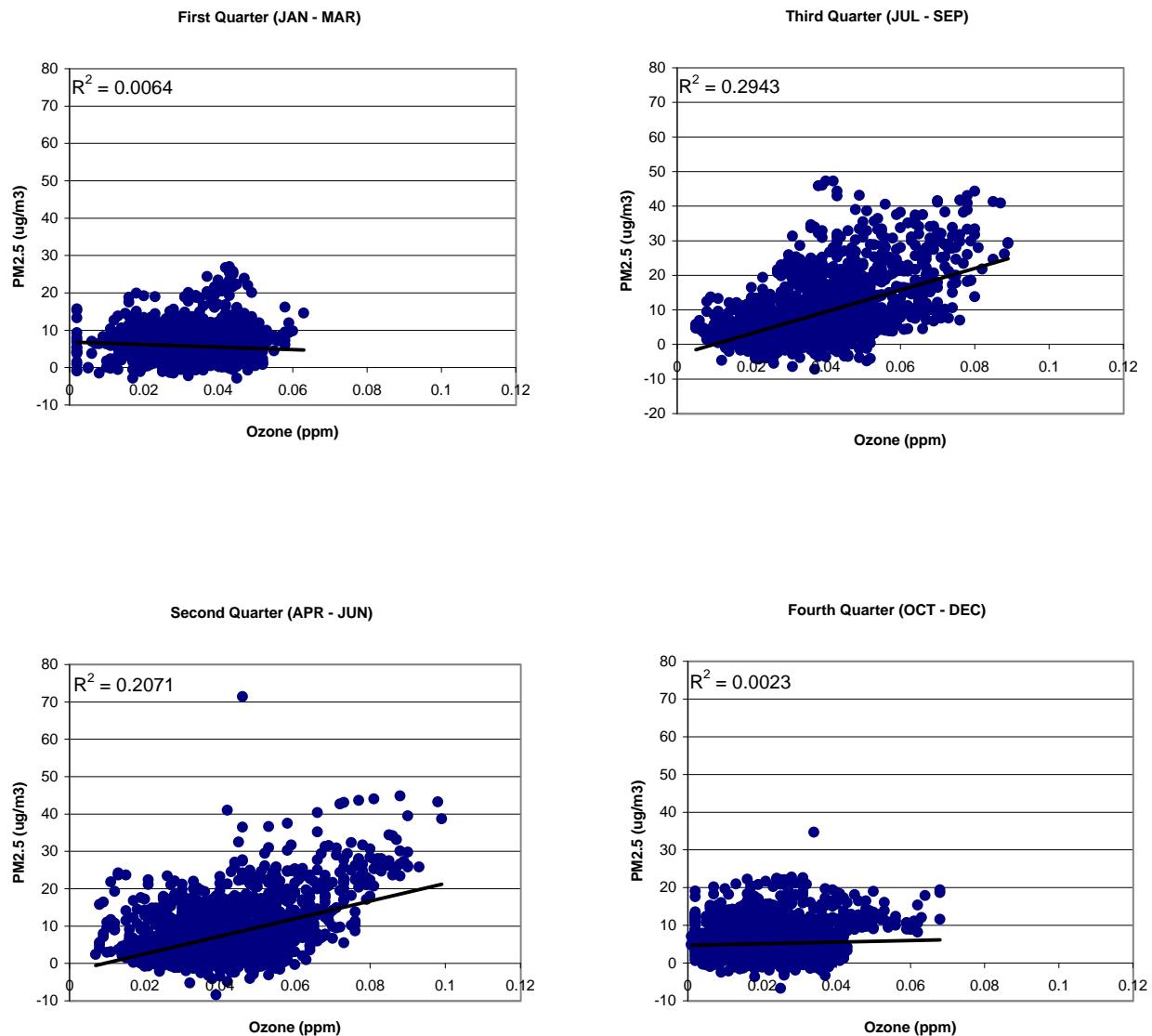


Figure C-4  
Quarterly Scatter Plots  
Ozone VS. PM2.5



## **APPENDIX D**

### **OZONE SUMMARY DATA PRODUCTS**

Ozone  
10 Highest Daily 1-Hour Average Maximum Concentrations  
Mayville Visibility Study

Final Validation  
12/01/2000 - 12/31/2000

Value	Date	Hour	Concentration (ppm)
Ozone			
1	12/30/2000	13	0.043*
2	12/31/2000	14	0.042
3	12/19/2000	11	0.039*
4	12/02/2000	20	0.037*
5	12/29/2000	0	0.037*
6	12/03/2000	0	0.036*
7	12/24/2000	14	0.036
8	12/25/2000	12	0.036
9	12/05/2000	14	0.035
10	12/08/2000	14	0.035* **

\* This value was also recorded during one or more hours later in the day.

\*\* This value was also recorded on one or more days later in the reported period.

Ozone			
10 Highest Daily 1-Hour Average Maximum Concentrations			
Mayville Visibility Study			
Final Validation			
01/01/2001 - 03/31/2001			
Value	Date	Hour	Concentration (ppm)
Ozone			
1	03/03/2001	14	0.063
2	03/22/2001	15	0.057
3	03/13/2001	1	0.055
4	03/09/2001	14	0.052*
5	03/18/2001	14	0.052
6	03/20/2001	14	0.052
7	03/01/2001	15	0.051
8	03/11/2001	13	0.050
9	02/23/2001	15	0.049
10	03/07/2001	14	0.049**

\* This value was also recorded during one or more hours later in the day.

\*\* This value was also recorded on one or more days later in the reported period.

Ozone			
10 Highest Daily 1-Hour Average Maximum Concentrations			
Mayville Visibility Study			
Final Validation 04/01/2001 - 06/30/2001			
Value	Date	Hour	Concentration (ppm)
Ozone			
1	06/13/2001	17	0.099
2	06/27/2001	14	0.093
3	06/28/2001	20	0.090
4	06/26/2001	15	0.085*
5	06/25/2001	17	0.081
6	06/29/2001	12	0.080
7	04/30/2001	14	0.079
8	05/17/2001	13	0.076*
9	05/20/2001	13	0.076*
10	06/24/2001	16	0.072**

\* This value was also recorded during one or more hours later in the day.

\*\* This value was also recorded on one or more days later in the reported period.

Ozone			
10 Highest Daily 1-Hour Average Maximum Concentrations			
Mayville Visibility Study			
Final Validation 07/01/2001 - 09/30/2001			
Value	Date	Hour	Concentration (ppm)
Ozone			
1	07/16/2001	16	0.089*
2	07/20/2001	23	0.087
3	07/21/2001	0	0.085
4	07/18/2001	14	0.081
5	07/08/2001	17	0.080
6	09/06/2001	15	0.080
7	07/17/2001	17	0.078
8	07/15/2001	15	0.076
9	07/30/2001	16	0.076
10	08/08/2001	14	0.074**

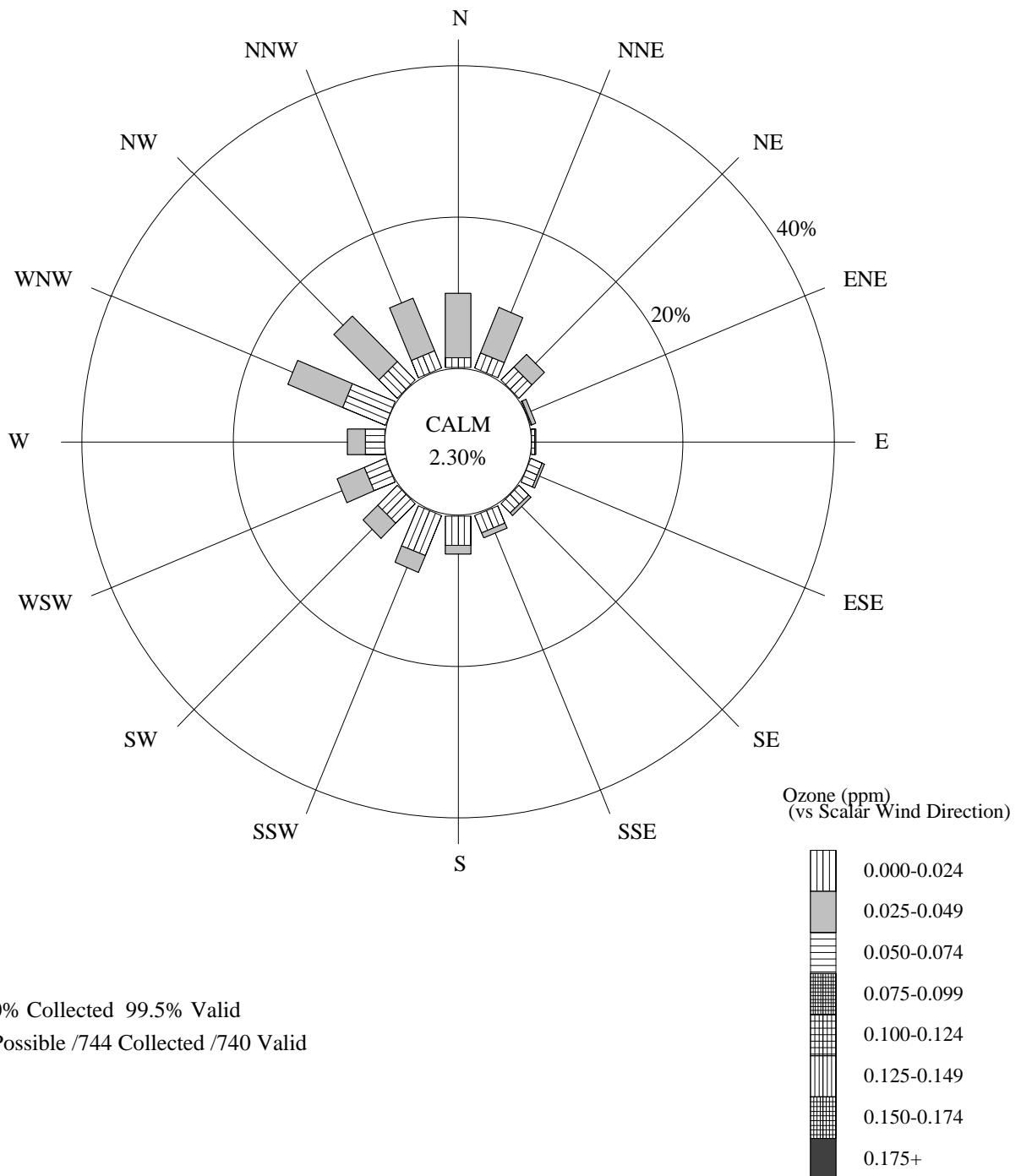
\* This value was also recorded during one or more hours later in the day.

\*\* This value was also recorded on one or more days later in the reported period.

Ozone			
10 Highest Daily 1-Hour Average Maximum Concentrations			
Mayville Visibility Study			
Final Validation 10/01/2001 - 12/31/2001			
Value	Date	Hour	Concentration (ppm)
Ozone			
1	10/02/2001	14	0.068*
2	10/01/2001	14	0.059
3	10/03/2001	0	0.056
4	10/09/2001	19	0.053
5	10/31/2001	21	0.048*
6	11/01/2001	0	0.046
7	10/21/2001	18	0.043
8	11/03/2001	14	0.043
9	10/07/2001	15	0.042
10	10/10/2001	0	0.042* **

\* This value was also recorded during one or more hours later in the day.

\*\* This value was also recorded on one or more days later in the reported period.

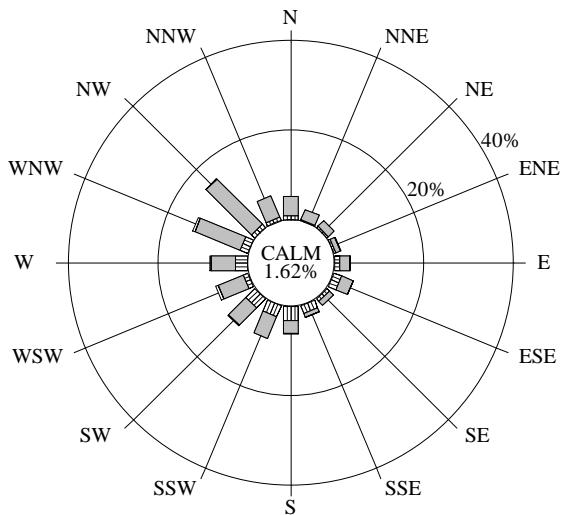


# Mayville Visibility Study

# Quarterly Ozone Pollutant Rose

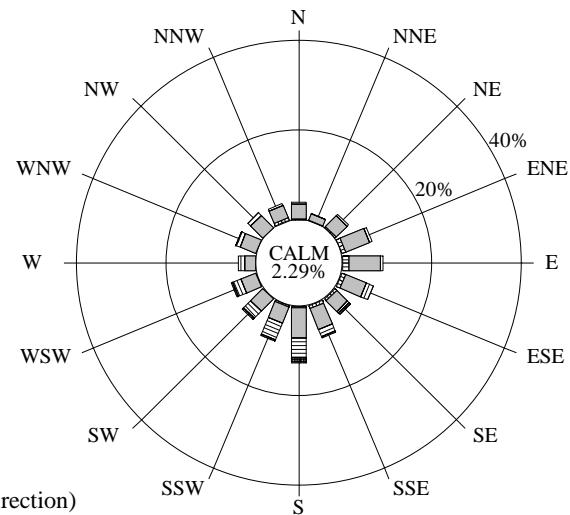
2001

FIRST QUARTER (JAN-MAR)



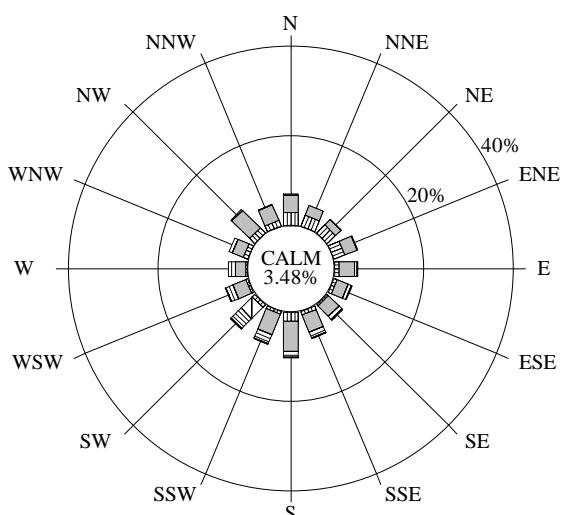
98.1% Collected 97.1% Valid  
2160 Possible /2118 Collected /2097 Valid

SECOND QUARTER (APR-JUN)

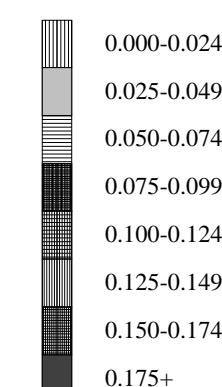


97.0% Collected 96.2% Valid  
2184 Possible /2119 Collected /2100 Valid

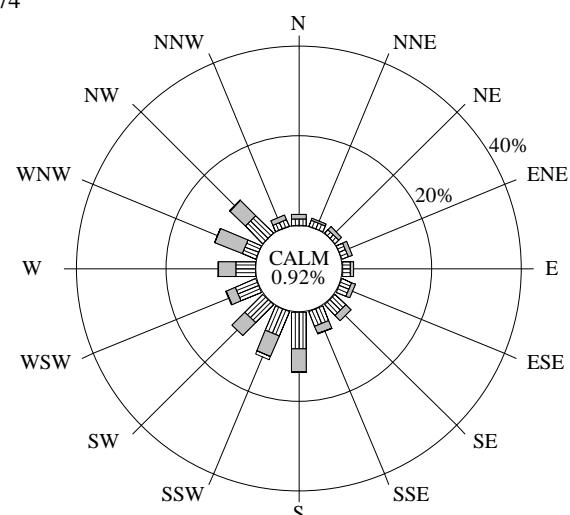
THIRD QUARTER (JUL-SEP)



100.0% Collected 96.2% Valid  
2208 Possible /2207 Collected /2124 Valid



FOURTH QUARTER (OCT-DEC)

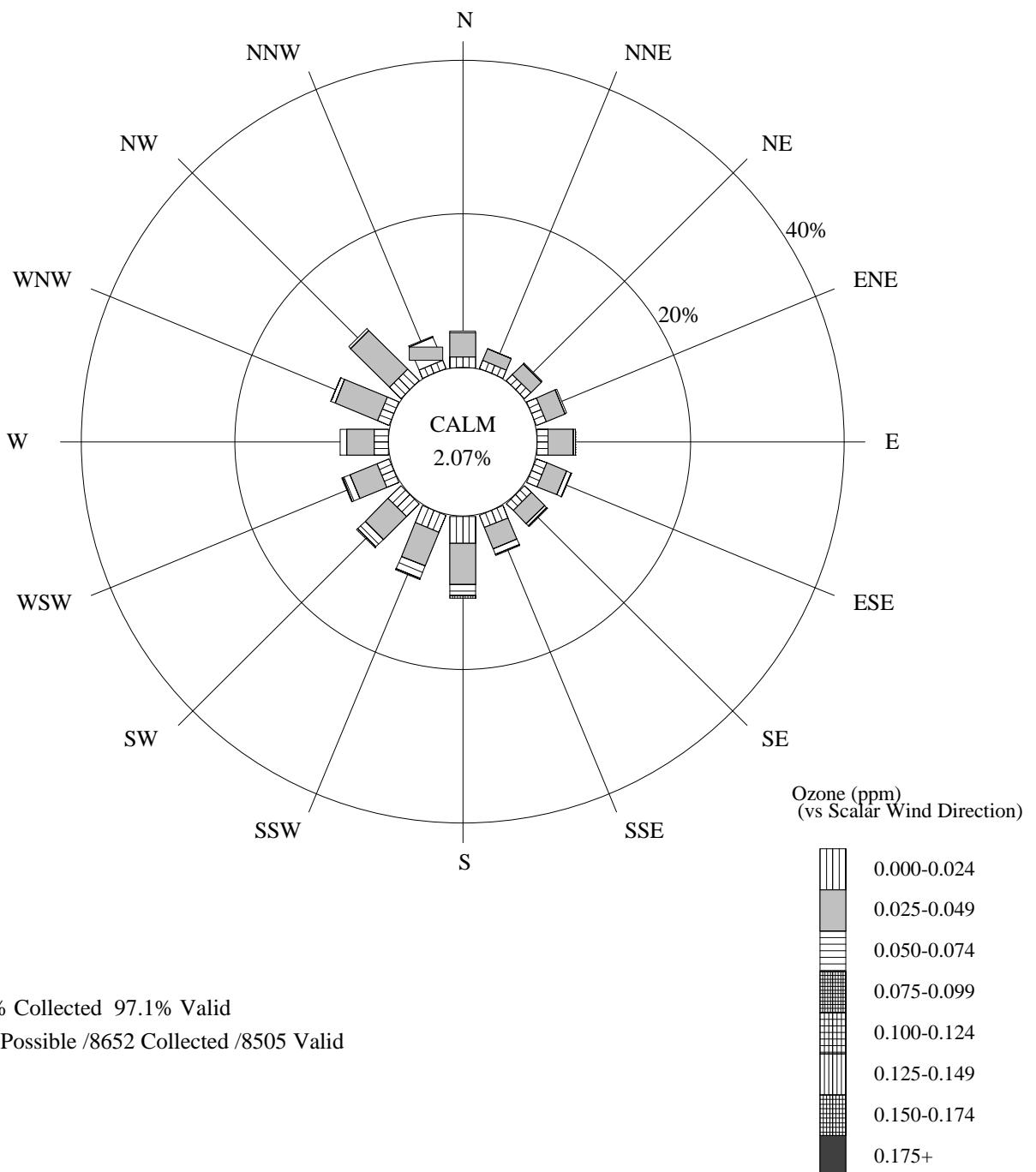


100.0% Collected 98.9% Valid  
2208 Possible /2208 Collected /2184 Valid

Mayville Visibility Study

Annual Ozone  
Pollutant Rose

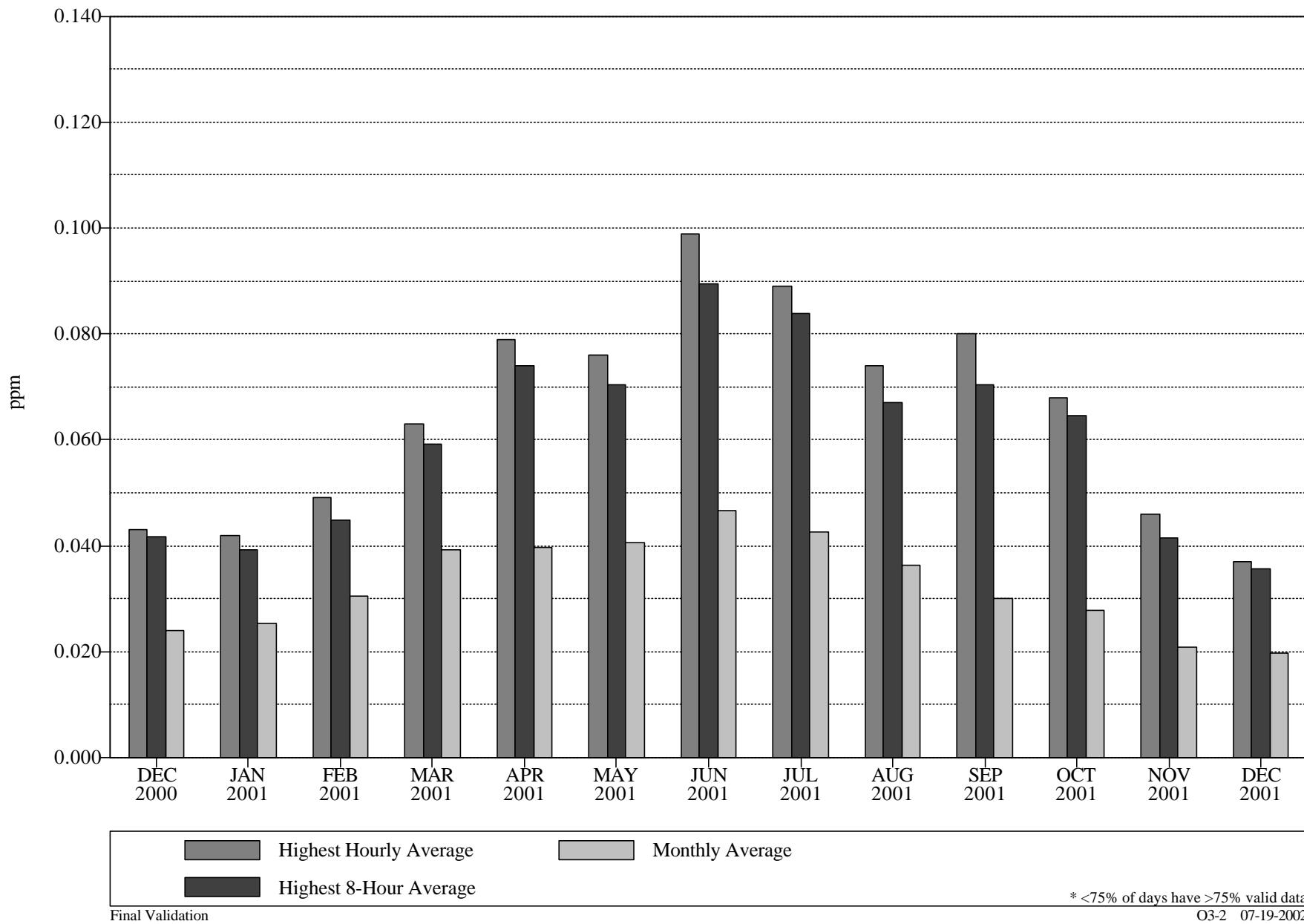
2001

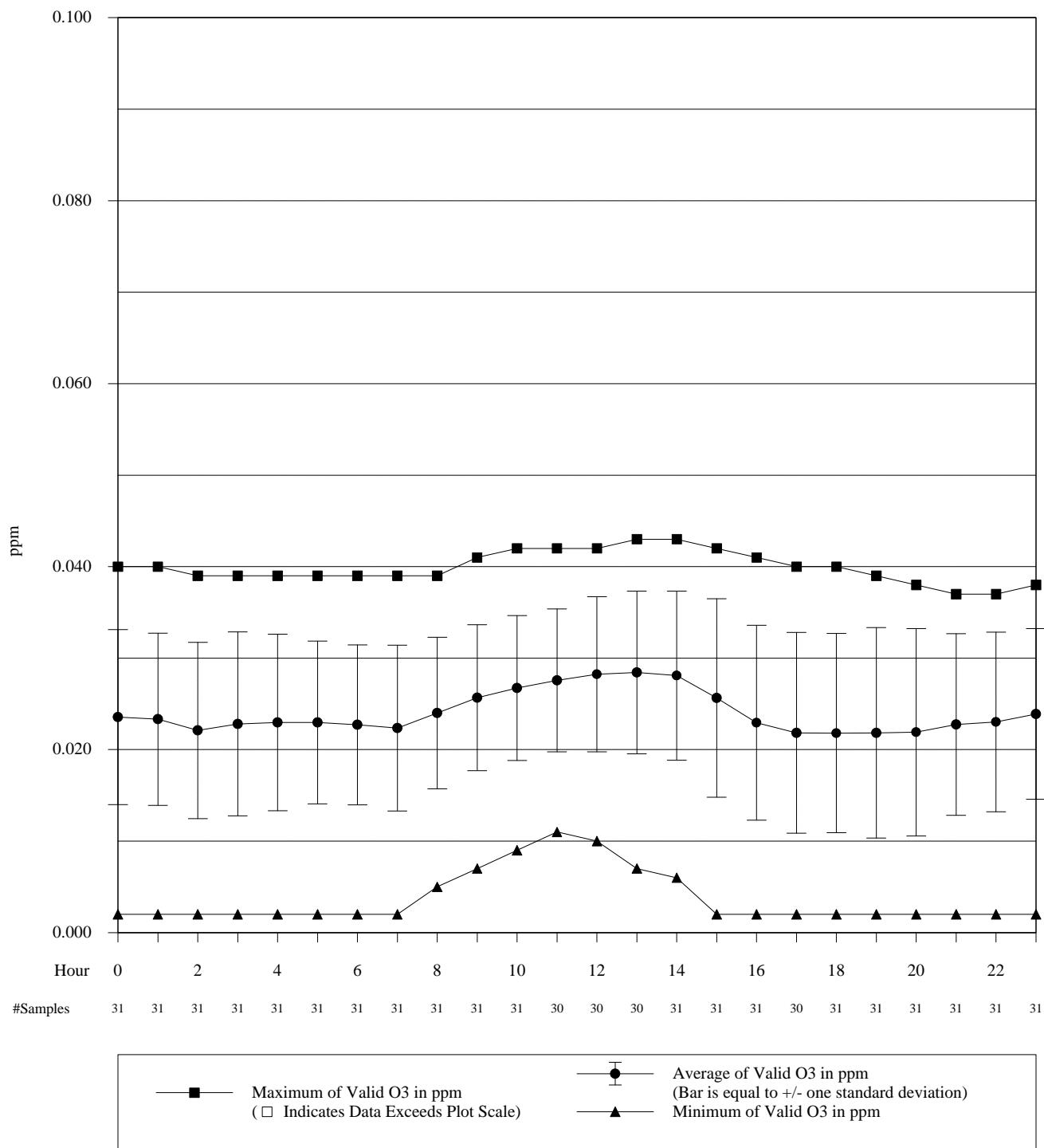


Mayville Visibility Study

Ozone Data Summary by Month  
December 2000 to December 2001

12/01/2000 - 12/31/2001

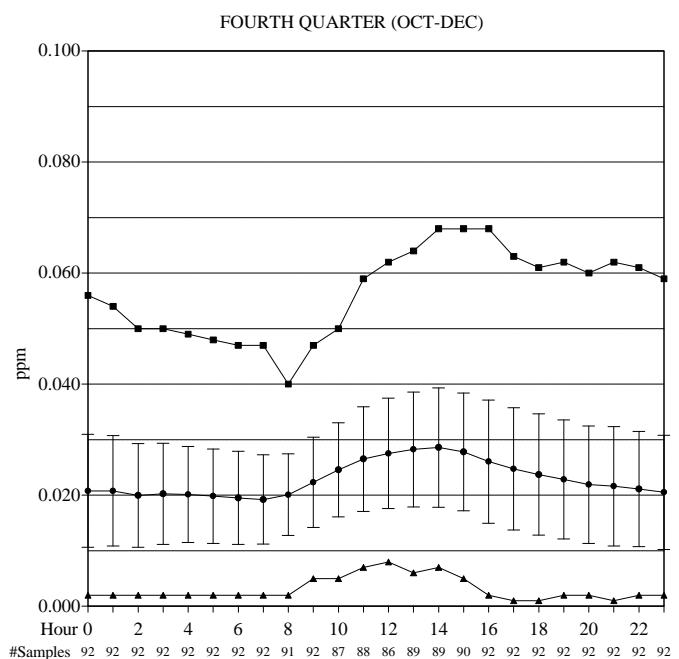
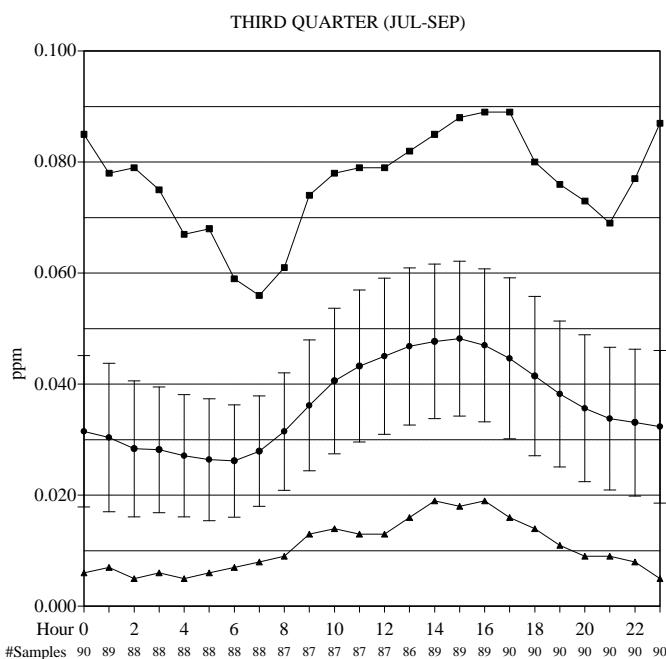
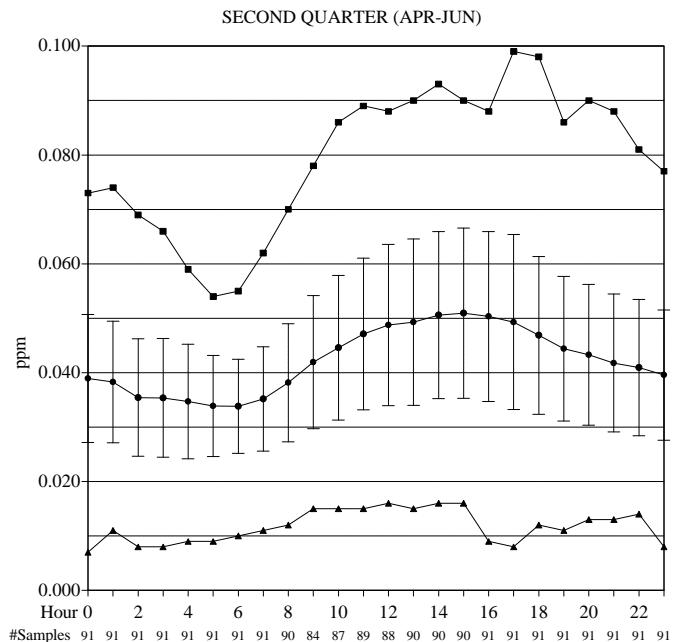
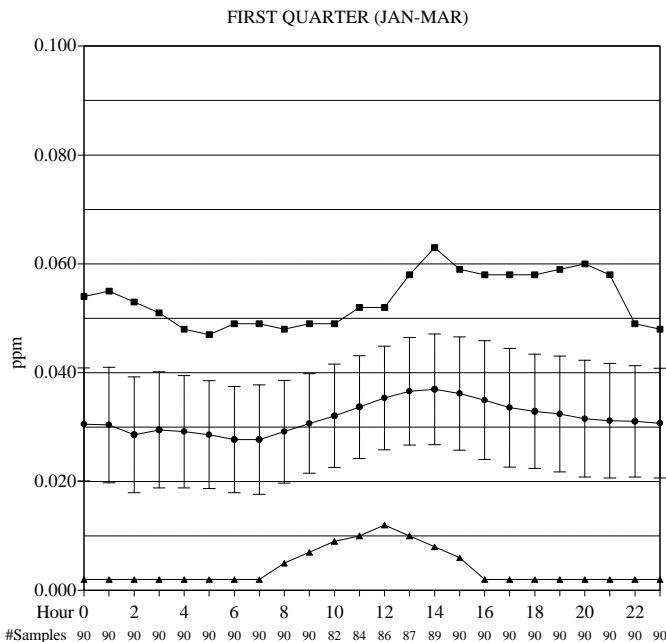




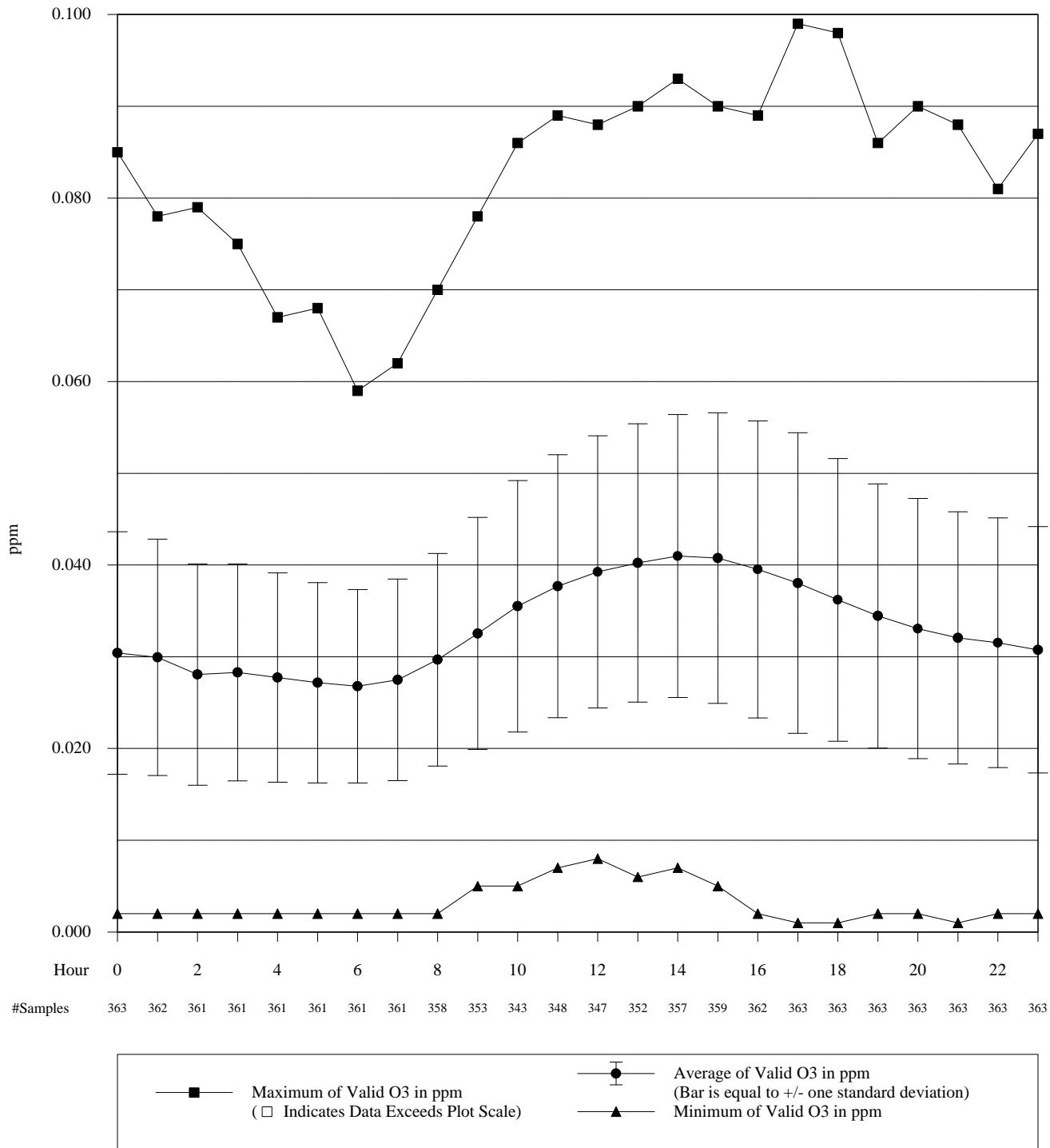
# Mayville Visibility Study

# Quarterly Diurnal Ozone Plots

2001



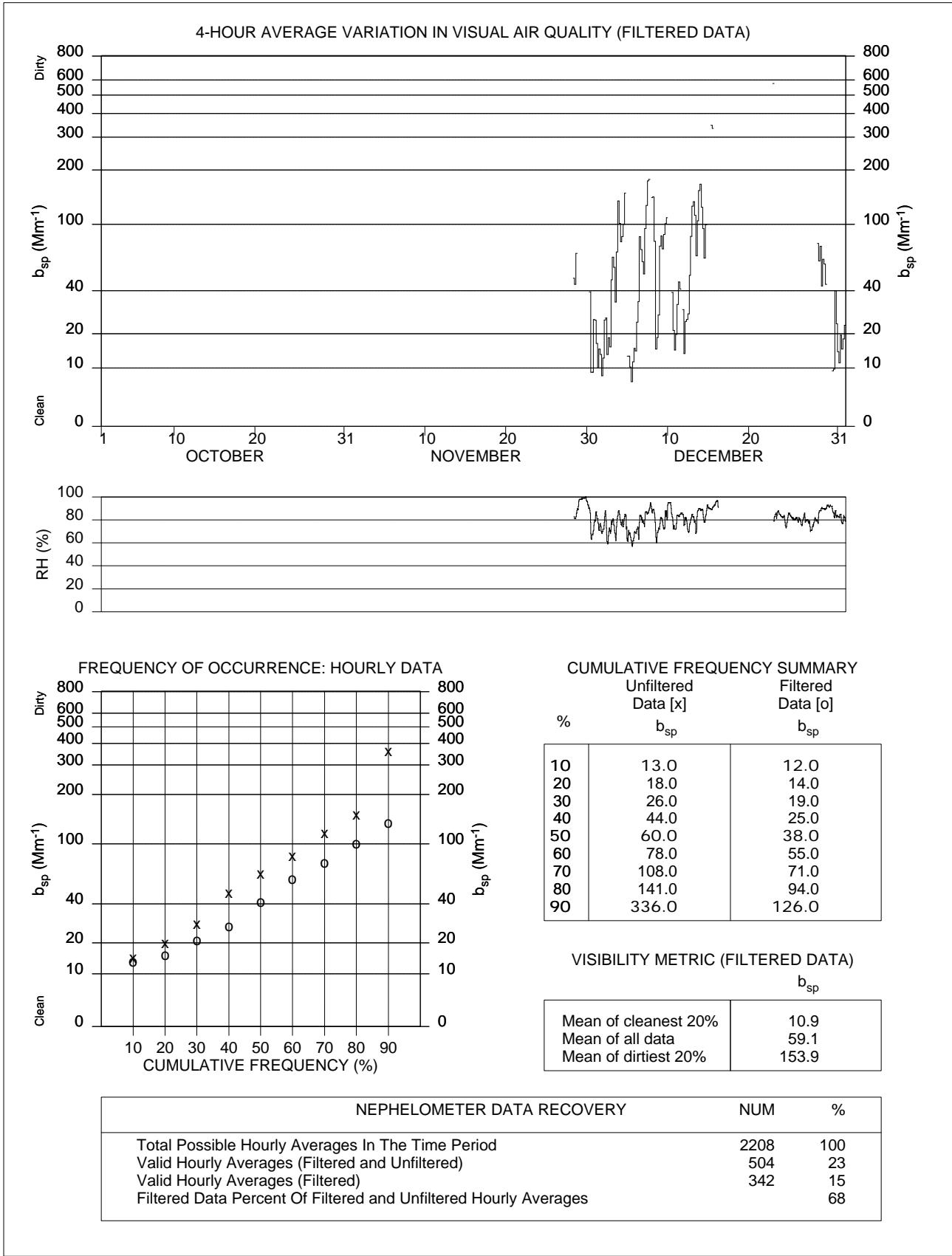
—■— Maximum of Valid O <sub>3</sub> in ppm	—□— Average of Valid O <sub>3</sub> in ppm (Bar is equal to +/- one standard deviation)
—△— Minimum of Valid O <sub>3</sub> in ppm	



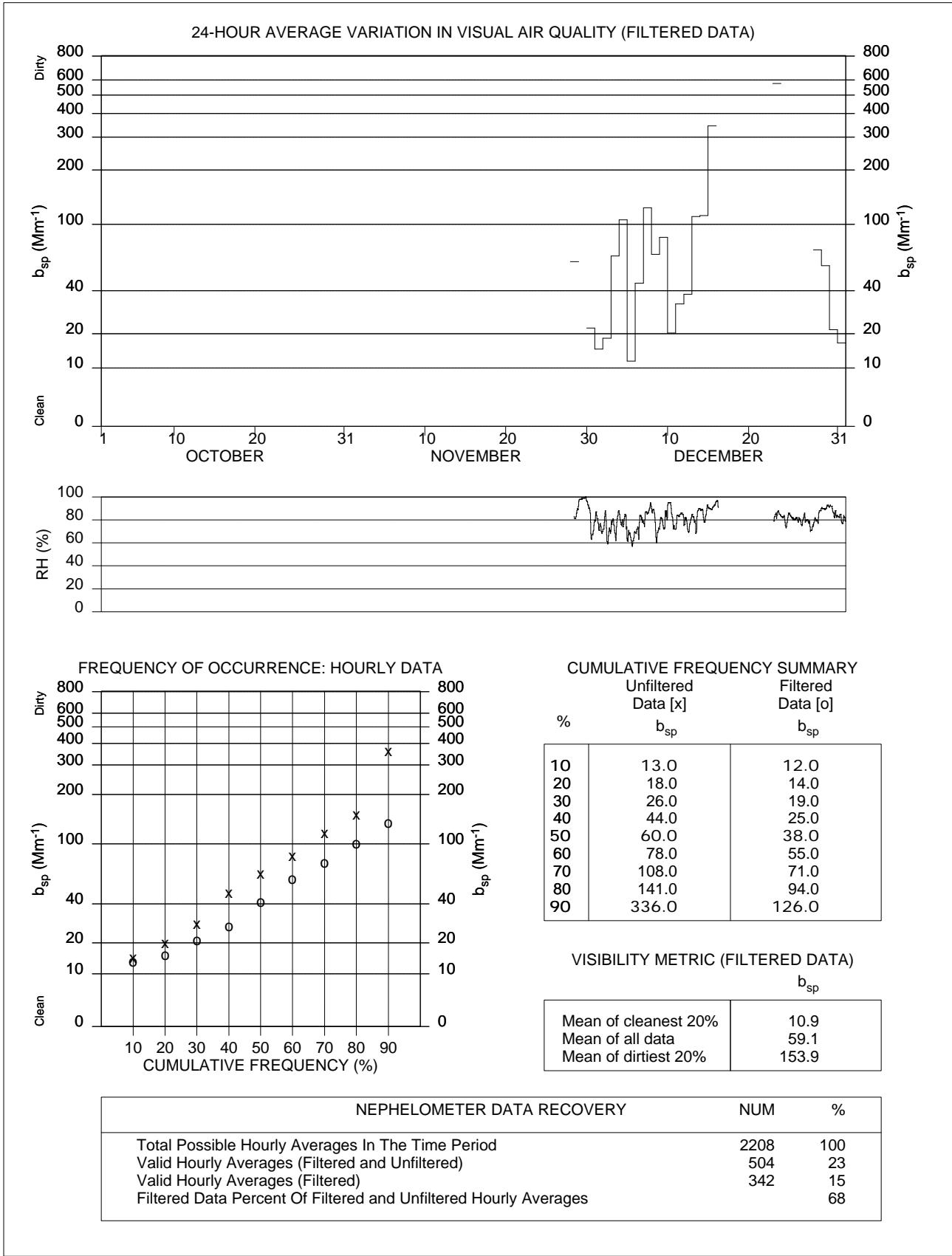
**APPENDIX E**

**NEPHELOMETER SUMMARY DATA PRODUCTS**

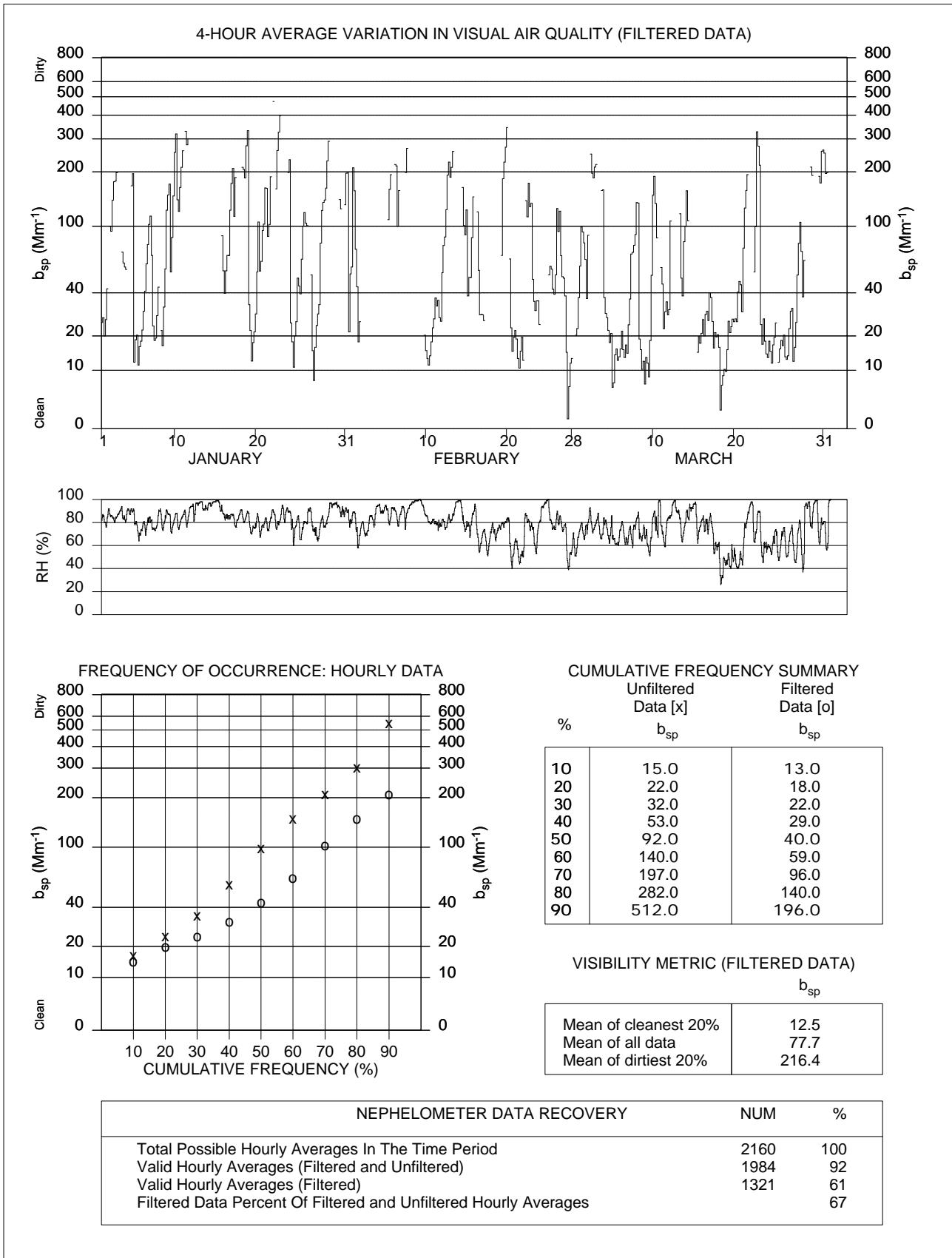
**MAYVILLE, WISCONSIN**  
**WISCONSIN DEPARTMENT OF NATURAL RESOURCES**  
**4th Quarter 2000: October 1, 2000 - December 31, 2000**



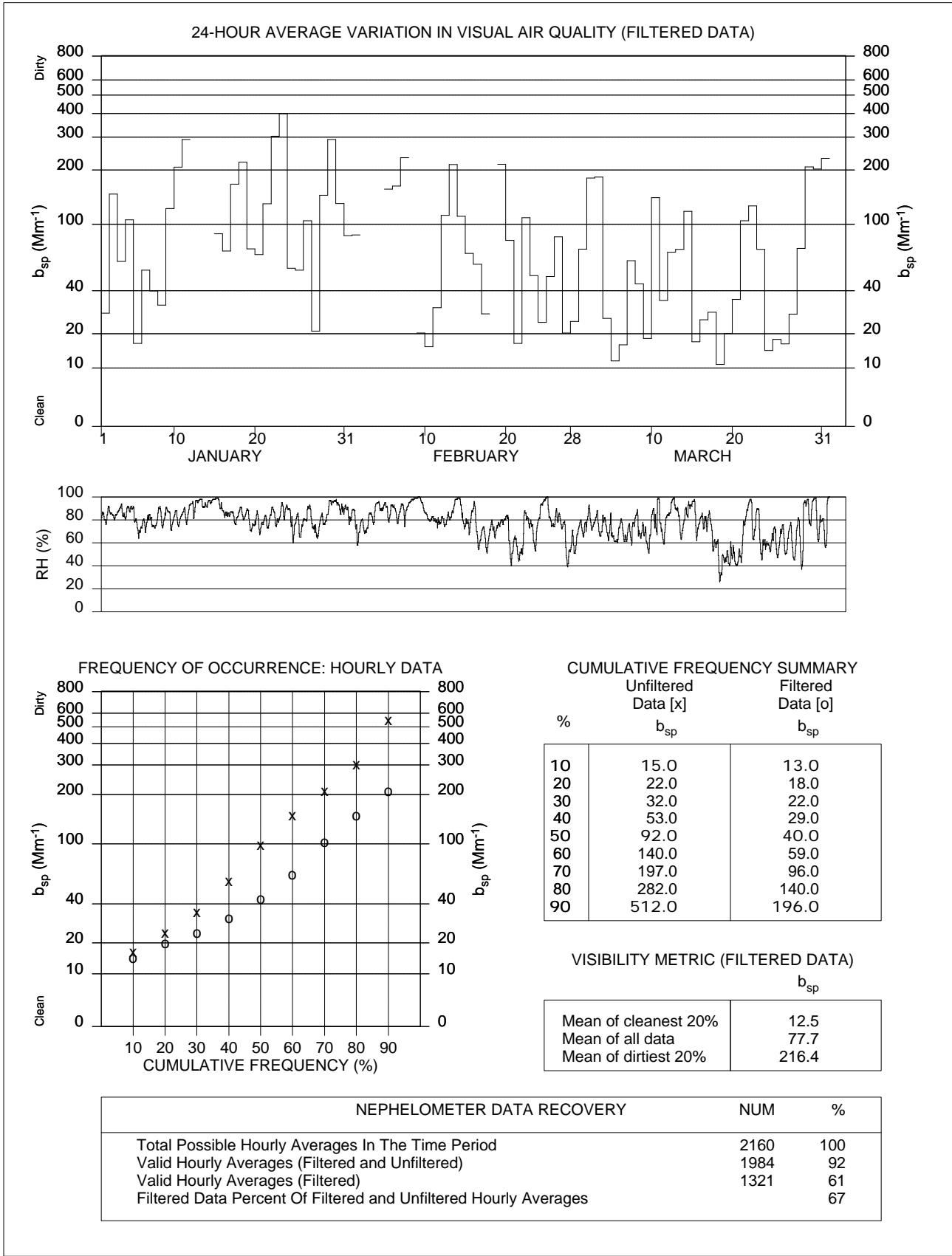
**MAYVILLE, WISCONSIN**  
**WISCONSIN DEPARTMENT OF NATURAL RESOURCES**  
**4th Quarter 2000: October 1, 2000 - December 31, 2000**



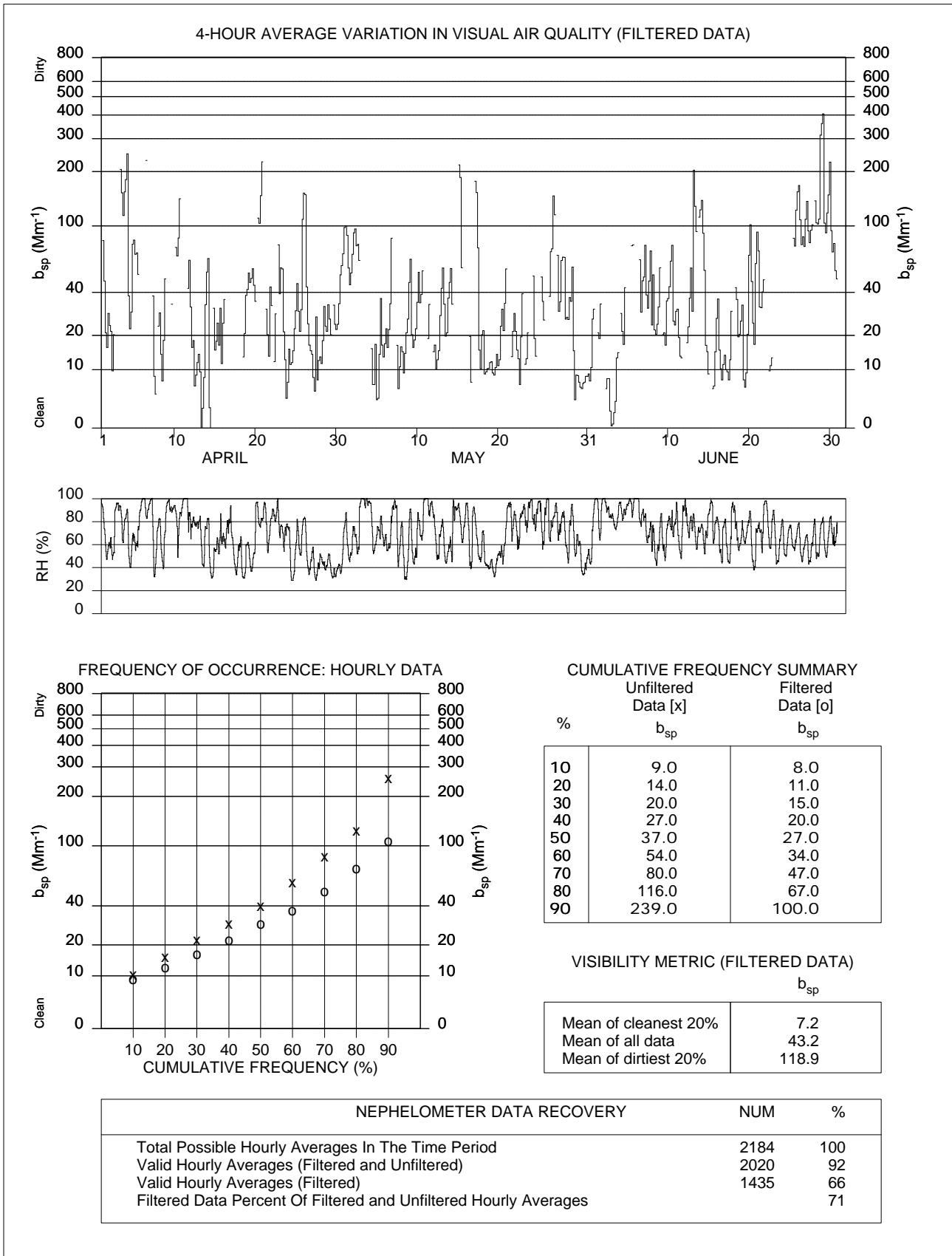
**MAYVILLE, WISCONSIN**  
**WISCONSIN DEPARTMENT OF NATURAL RESOURCES**  
**1st Quarter 2001: January 1, 2001 - March 31, 2001**



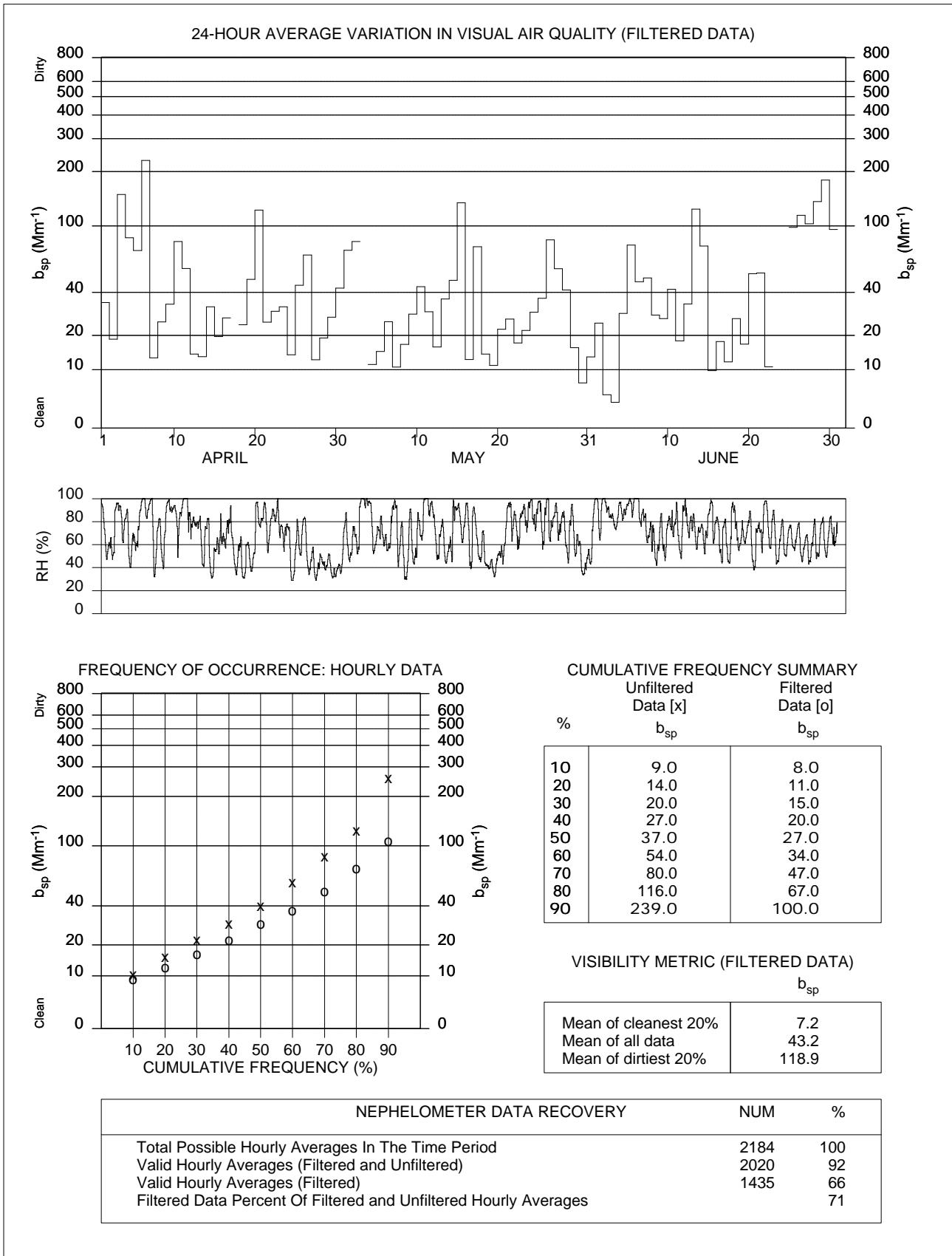
**MAYVILLE, WISCONSIN**  
**WISCONSIN DEPARTMENT OF NATURAL RESOURCES**  
**1st Quarter 2001: January 1, 2001 - March 31, 2001**



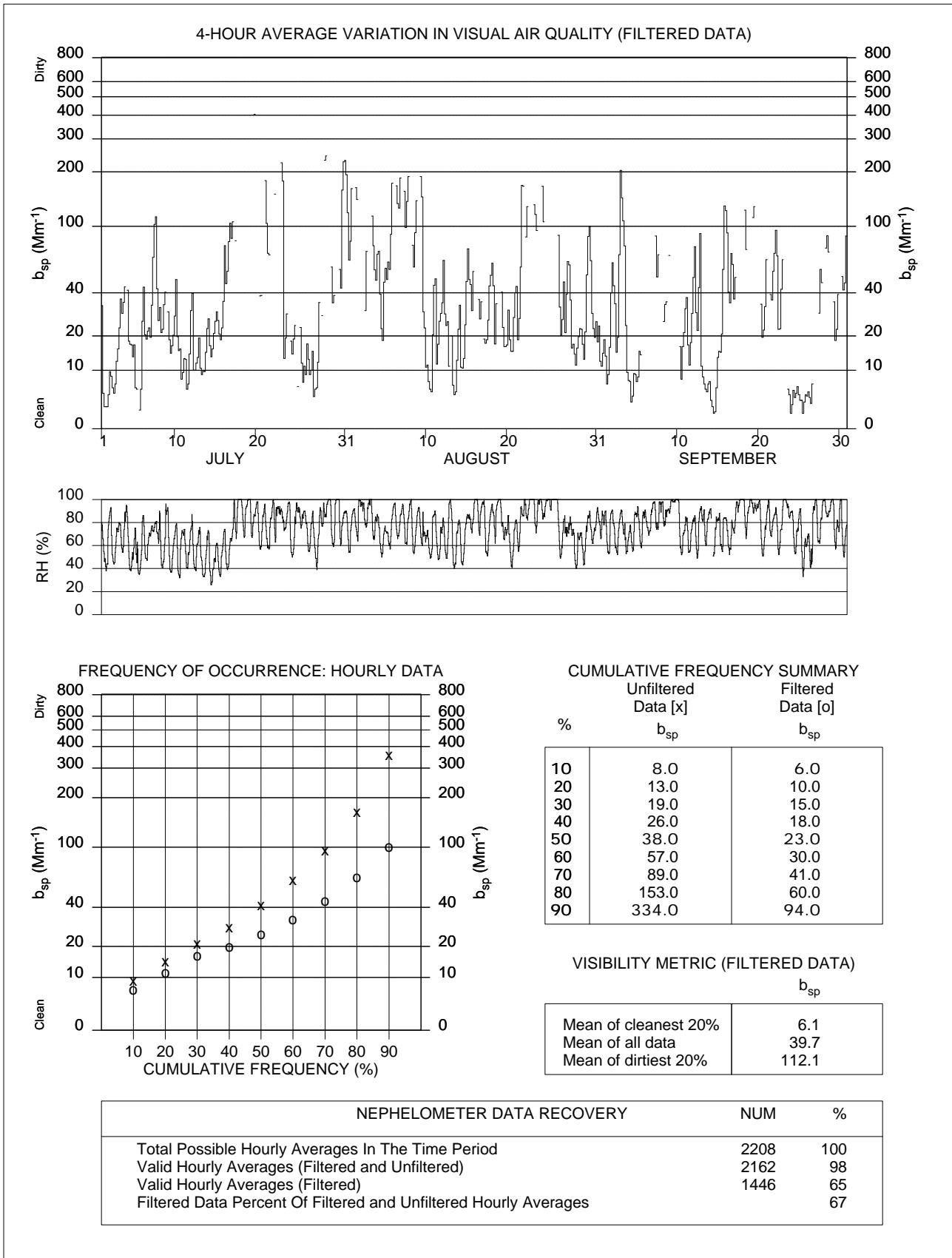
**MAYVILLE, WISCONSIN**  
**WISCONSIN DEPARTMENT OF NATURAL RESOURCES**  
**2nd Quarter 2001: April 1, 2001 - June 30, 2001**



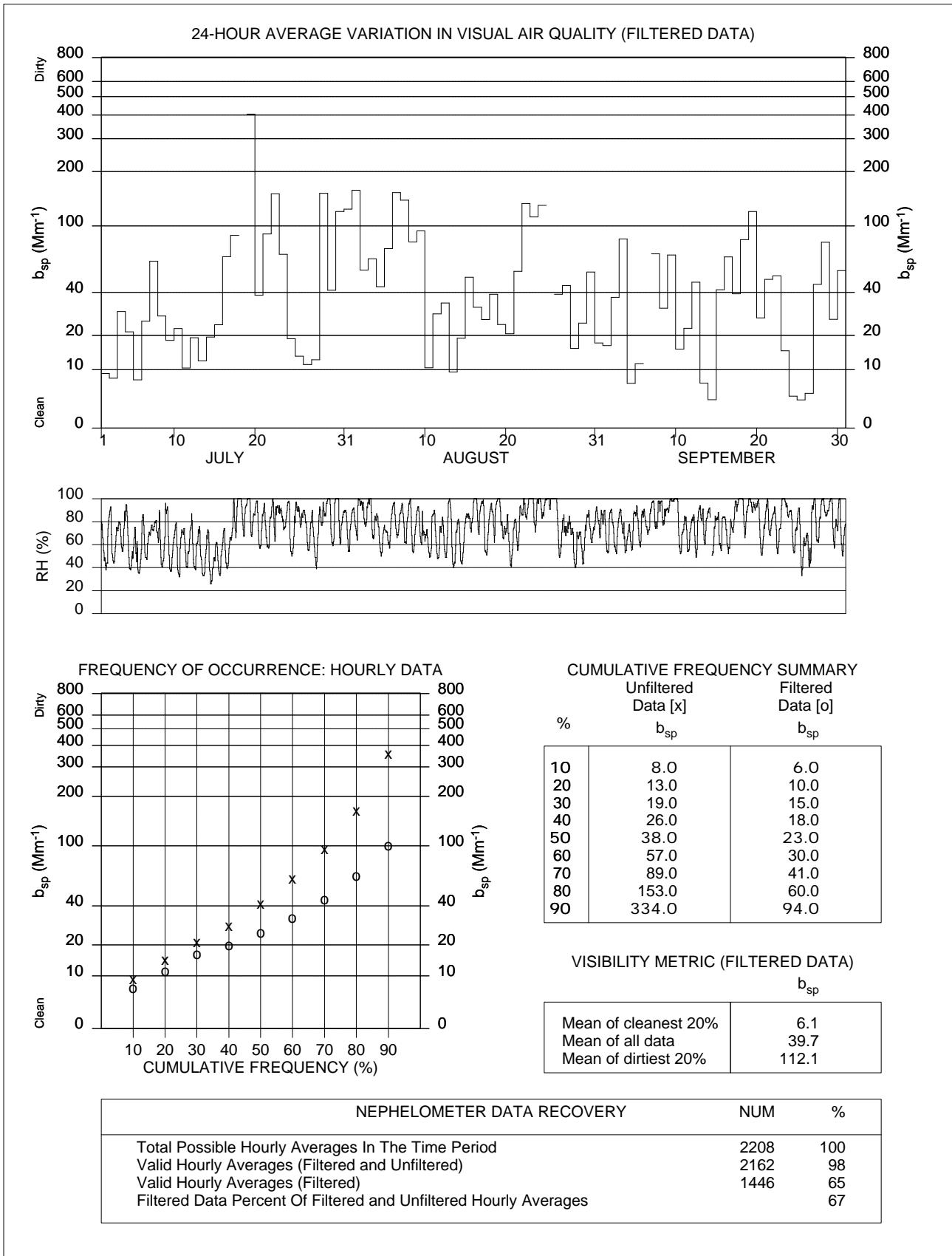
**MAYVILLE, WISCONSIN**  
**WISCONSIN DEPARTMENT OF NATURAL RESOURCES**  
**2nd Quarter 2001: April 1, 2001 - June 30, 2001**



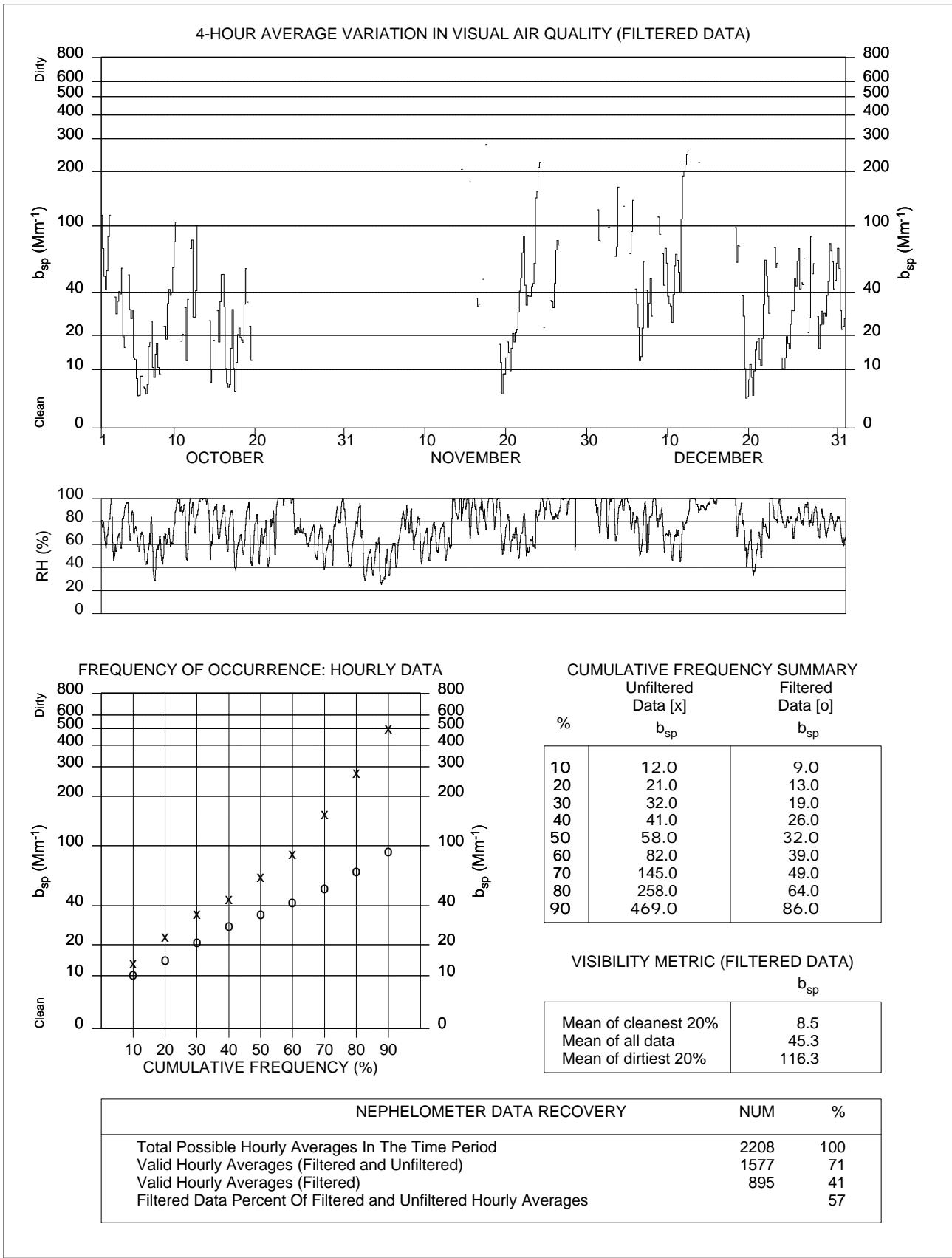
**MAYVILLE, WISCONSIN**  
**WISCONSIN DEPARTMENT OF NATURAL RESOURCES**  
**3rd Quarter 2001: July 1, 2001 - September 30, 2001**



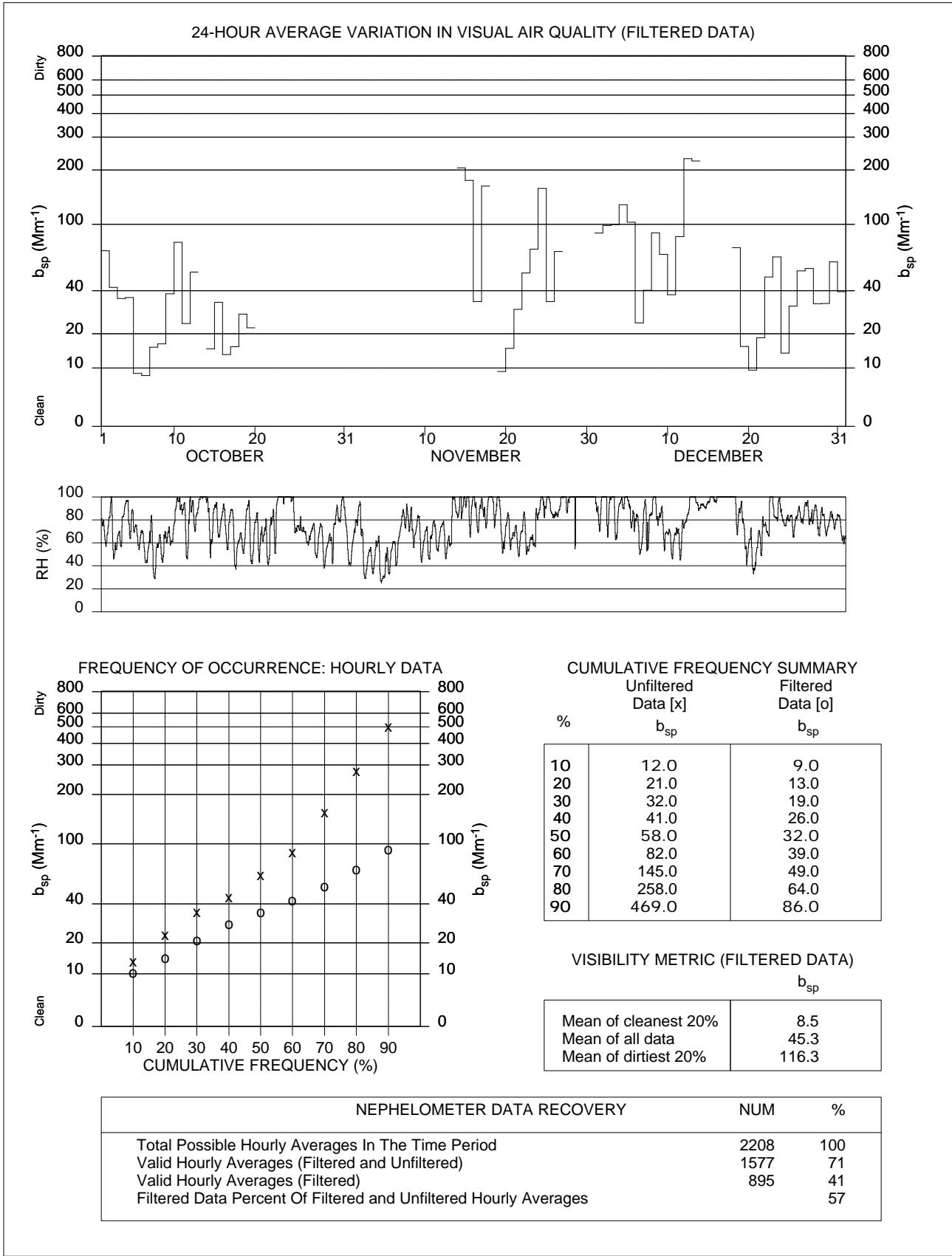
**MAYVILLE, WISCONSIN**  
**WISCONSIN DEPARTMENT OF NATURAL RESOURCES**  
**3rd Quarter 2001: July 1, 2001 - September 30, 2001**

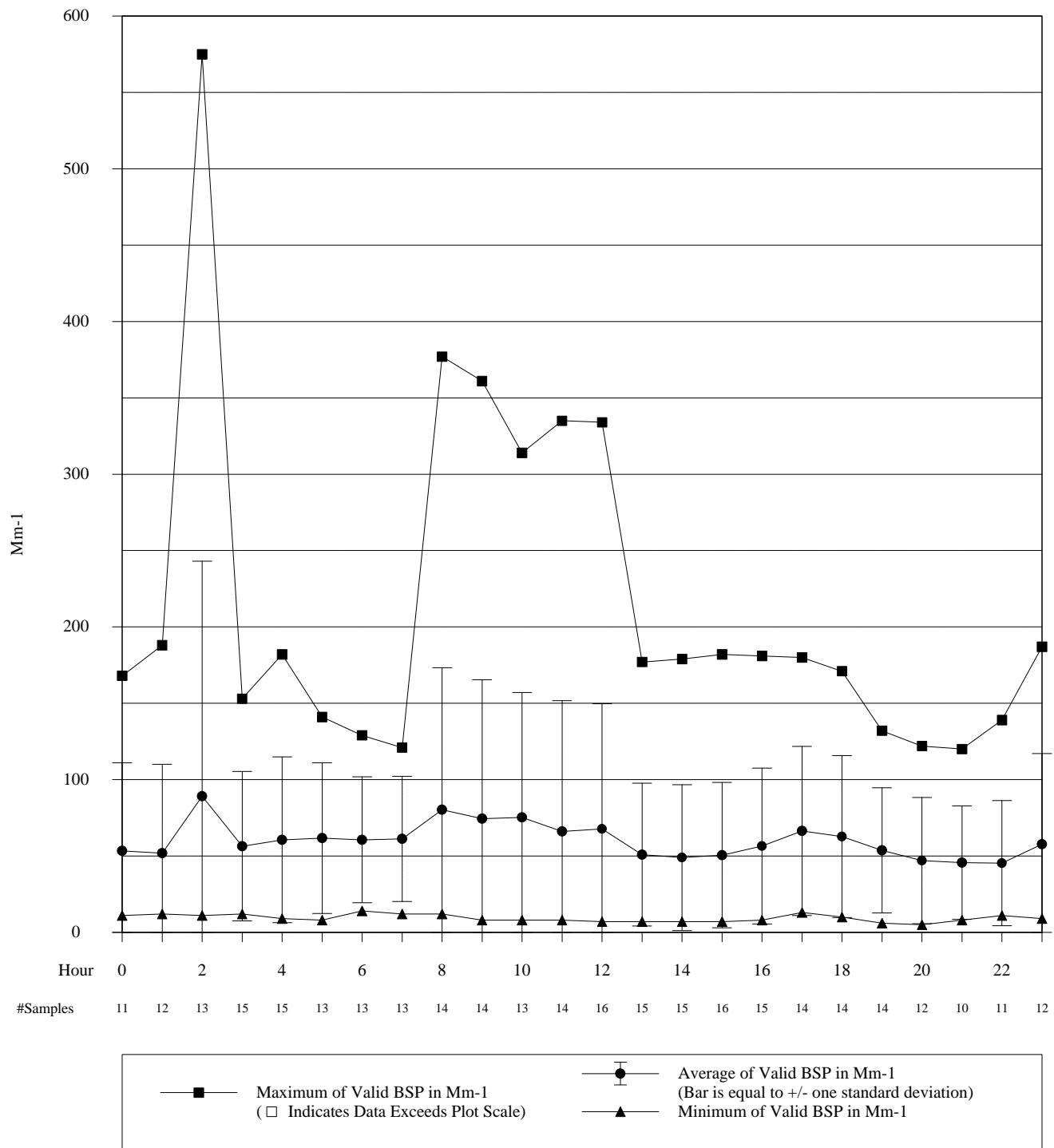


**MAYVILLE, WISCONSIN**  
**WISCONSIN DEPARTMENT OF NATURAL RESOURCES**  
**4th Quarter 2001: October 1, 2001 - December 31, 2001**



**MAYVILLE, WISCONSIN**  
**WISCONSIN DEPARTMENT OF NATURAL RESOURCES**  
**4th Quarter 2001: October 1, 2001 - December 31, 2001**

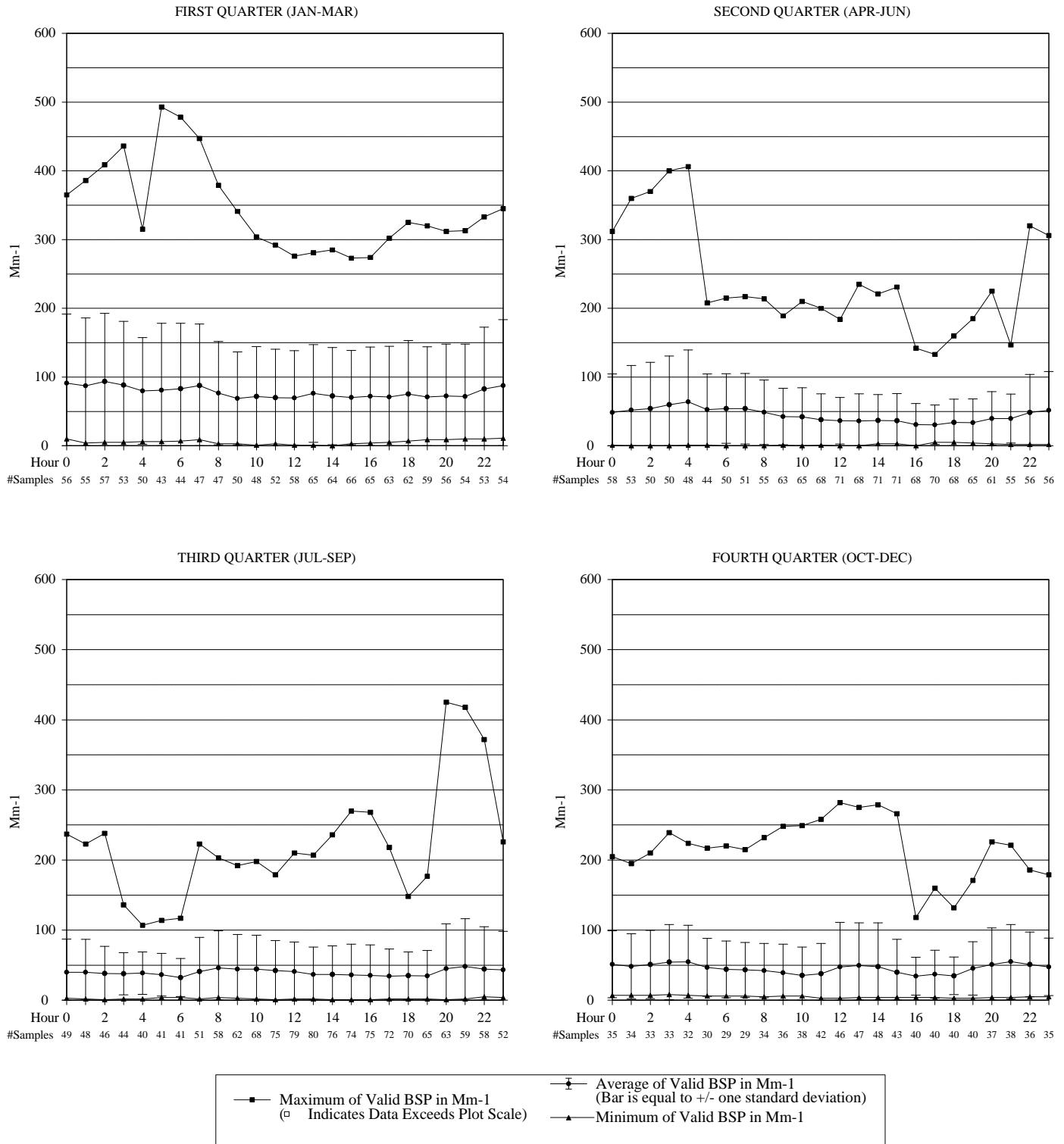


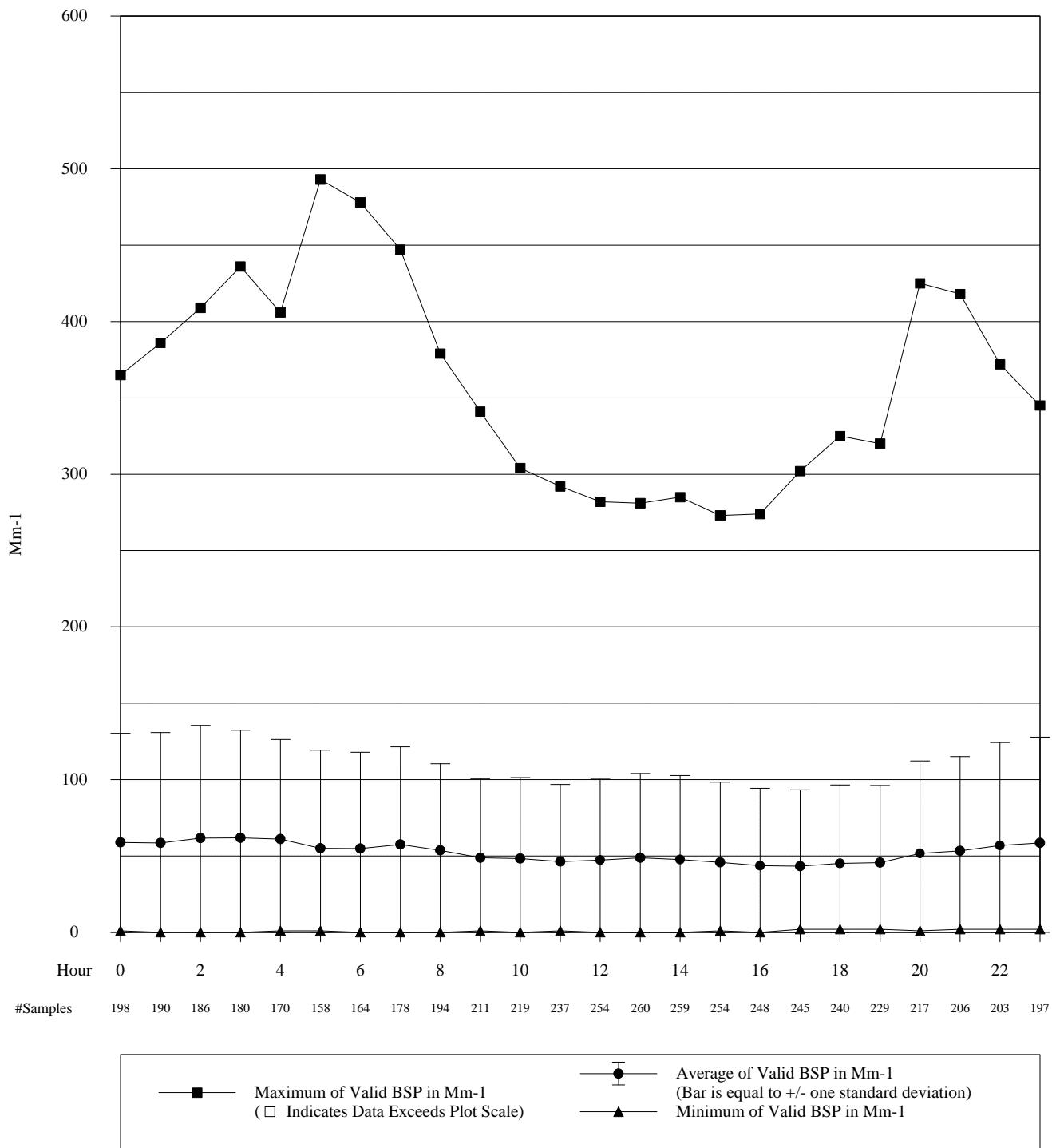


# Mayville Visibility Study

## Quarterly Diurnal Light Scattering (Bsp) Plots

2001





## **APPENDIX F**

### **NEPHELOMETER OPERATIONAL TIMELINES**

Mayville Nephelometer  
Operational Timeline

December 1, 2000 - February 28, 2001

Date	Summary
11/29/00	Site visit. Analog data collection begins with Nephelometer SN 044 installed.
12/01/00	Site visit. Serial data collection begins. Nephelometer calibrated.
12/06/00	Site visit. Nephelometer calibrated. Changed filter in clean air canister.
12/13/00	Site visit. Nephelometer calibrated. (Z=53; S=129).
12/20/00	Site visit. Cable connection bad to AT/RH sensor.
12/21/00	Site visit. New cable corrects erroneous AT/RH readings (12/18 – 12/21).
12/28/00	Site visit. Lamp replaced (out 12/23 – 12/28). Nephelometer calibrated.
01/02/01	Site visit. Nephelometer calibrated.
01/05/01	Site visit. Nephelometer calibrated.
01/17/01	Site visit. Nephelometer calibrated.
01/18/01	Site visit. Lamp replaced (out 1/17 – 1/18).
01/24/01	Site visit. Nephelometer calibrated.
01/31/01	Site visit. Nephelometer calibrated.
02/05/01	Site visit. Lamp replaced (out 2/1 – 2/5).
02/14/01	Site visit. Nephelometer calibrated.
02/19/01	Site visit. Lamp replaced (out 2/17 – 2/19).
02/23/01	Site visit. Nephelometer calibrated.

**Mayville Nephelometer  
Operational Timeline**

March 1, 2001 - May 31, 2001

Date	Summary
3/02/01	Nephelometer SN 044 in operation. Site visit. Nephelometer calibrated ( $Z=86.4$ ; $S=154.3$ ).
3/04/01	Site visit. Nephelometer calibrated three times ( $Z=82.5$ ; $S=153.8$ ), ( $Z=80.0$ ; $S=152.0$ ), ( $Z=80.1$ ; $S=152.9$ ).
3/13/01	Site visit. Nephelometer calibrated ( $Z=96.4$ ; $S=161.3$ ).
3/28/01	Site visit. Nephelometer calibrated ( $Z=81.2$ ; $S=151.2$ ).
4/10/01	Site visit. Nephelometer calibrated ( $Z=77.4$ ; $S=143.6$ ).
4/17/01	Site visit. Lamp replaced (out 4/16 - 4/17). Nephelometer placed in shelter due to chopper failure.
4/18/01	Site visit. Nephelometer calibrated in shelter ( $Z=70.6$ ; $S=135.7$ ). Chopper replaced (out 4/16 – 4/18). Nephelometer reinstalled outside of shelter and calibrated ( $Z=70.8$ ; $S=138.7$ ).
4/30/01	Site visit. Nephelometer calibrated ( $Z=74.1$ ; $S=137.8$ ).
5/07/01	Site visit. Nephelometer calibrated ( $Z=82.0$ ; $S=144.9$ ).
5/16/01	Site visit. Nephelometer calibrated ( $Z=74.5$ ; $S=135.5$ ). Lamp replaced (out 5/15 – 5/16).
5/24/01	Site visit. Nephelometer calibrated ( $Z=79.6$ ; $S=146.0$ ).

**Mayville Nephelometer  
Operational Timeline**

June 1, 2001 - August 31, 2001

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Date	Summary
06/01/01	Nephelometer SN 044 in operation. Site visit. Nephelometer calibrated (Z=79.6; S=144.4).
06/12/01	Site visit. Nephelometer calibrated (Z=77.9; S=138.1).
06/17/01	Site visit. Nephelometer calibrated three times (Z=76.9; S=140.4), (Z=79.6; S=141.7), (Z=76.9; S=140.4).
06/20/01	Site visit. Nephelometer calibrated (Z=77.2; S=137.7).
06/21/01	Site visit. Nephelometer calibrated (Z=76.1; S=139.9).
06/25/01	Site visit. Nephelometer calibrated (Z=81.7; S=143.2). Lamp Replaced (out 6/21 – 6/25).
07/05/01	Site visit. Nephelometer calibrated (Z=80.6; S=147.3).
07/20/01	Site visit. Nephelometer calibrated two times (Z=78.6; S=139.0), (Z=79.4; S=138.9).
07/26/01	Site visit. Nephelometer calibrated (Z=79.9; S=144.1).
08/07/01	Site visit. Nephelometer calibrated (Z=84.1; S=142.5).
08/31/01	Site visit. Nephelometer calibrated (Z=90.8; S=152.8).

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**Mayville Nephelometer  
Operational Timeline**

September 1, 2001 - November 30, 2001

Date	Summary
09/07/01	Nephelometer SN 044 in operation. Site visit. Nephelometer calibrated (Z=88.0; S=150.2). Lamp replaced (out 9/5 – 9/7).
09/26/01	Site visit. Nephelometer calibrated (Z=89.1; S=155.1).
10/05/01	Site visit. Nephelometer calibrated (Z=91.2; S=159.6).
10/19/01	Site visit. Nephelometer calibrated (Z=93.5; S=158.5). Nephelometer SN 044 removed for annual service.
11/14/01	Site visit. Nephelometer SN 044 re-installed. Nephelometer calibrated twice (Z=30.3; S=99.4), (Z=29.6; S=100.5).
11/19/01	Site visit. Nephelometer calibrated (Z=30.9; S=106.4).
11/28/01	Site visit. Nephelometer calibrated (Z=31.5; S=108.1).

**Mayville Nephelometer  
Operational Timeline**

December 1, 2001 - March 31, 2002

Date	Summary
12/07/01	Nephelometer SN 044 in operation. Site visit. Nephelometer calibrated ( $Z=31.5$ ; $S=107.6$ ). AT/RH sensor audited (NIST Standard).
12/29/01	Site visit. Nephelometer calibrated ( $Z=33.2$ ; $S=114.3$ ). AT/RH sensor audited (NIST Standard).
01/10/02	Site visit. Nephelometer calibrated ( $Z=35.5$ ; $S=109.7$ ). AT/RH sensor audited.
02/01/02	Site visit. AT/RH sensor audited.
02/03/02	Site visit. Lamp replaced (out 2/1 – 2/3).
02/13/02	Site visit. AT/RH sensor audited.
02/26/02	Site visit. Nephelometer calibrated ( $Z=37.2$ ; $S=114.8$ ). AT/RH sensor audited.
03/11/02	Site visit. Nephelometer calibrated ( $Z=37.6$ ; $S=111.4$ ). AT/RH sensor audited.
03/18/02	Site visit. Nephelometer calibrated ( $Z=38.8$ ; $S=99.7$ ).
03/19/02	Site visit. AT/RH sensor audited.
03/27/02	Site visit. Multipoint audit performed on AT/RH sensor with NIST Standard.

**APPENDIX G**

**PM<sub>2.5</sub> SUMMARY DATA PRODUCTS**

**PM2.5 TEOM**  
10 Highest Daily 1-Hour Average Maximum Concentrations  
Mayville Visibility Study

Final Validation  
12/01/2000 - 12/31/2000

Value	Date	Hour	Concentration (ug/m <sup>3</sup> lc)
<b>PM2.5 TEOM</b>			
1	12/15/2000	18	22.5
2	12/16/2000	17	17.3
3	12/28/2000	18	16.9
4	12/08/2000	23	15.6
5	12/25/2000	12	11.9
6	12/18/2000	16	11.3
7	12/07/2000	13	10.8
8	12/13/2000	9	10.8
9	12/10/2000	8	10.6
10	12/09/2000	0	9.9

**PM2.5 TEOM**  
10 Highest Daily 1-Hour Average Maximum Concentrations  
Mayville Visibility Study

Final Validation  
01/01/2001 - 03/31/2001

Value	Date	Hour	Concentration (ug/m <sup>3</sup> lc)
PM2.5 TEOM			
1	03/30/2001	16	27.0
2	03/31/2001	15	25.6
3	03/28/2001	19	21.1
4	01/12/2001	10	20.8
5	03/29/2001	17	20.3
6	03/17/2001	12	19.3
7	02/05/2001	8	19.2
8	01/13/2001	21	16.8
9	01/11/2001	14	16.3
10	03/03/2001	21	16.2

**PM2.5 TEOM**  
10 Highest Daily 1-Hour Average Maximum Concentrations  
Mayville Visibility Study

Final Validation  
04/01/2001 - 06/30/2001

Value	Date	Hour	Concentration (ug/m <sup>3</sup> lc)
PM2.5 TEOM			
1	04/07/2001	21	71.4
2	06/28/2001	21	44.8
3	06/13/2001	18	43.2
4	06/29/2001	0	43.1
5	06/26/2001	9	31.7
6	06/27/2001	17	29.8
7	04/29/2001	18	27.7
8	05/16/2001	21	25.8
9	05/02/2001	18	24.6
10	06/14/2001	6	24.5

**PM2.5 TEOM**  
**10 Highest Daily 1-Hour Average Maximum Concentrations**  
**Mayville Visibility Study**

Final Validation  
 07/01/2001 - 09/30/2001

Value	Date	Hour	Concentration (ug/m <sup>3</sup> lc)
PM2.5 TEOM			
1	08/09/2001	3	47.2*
2	09/06/2001	15	44.3
3	07/19/2001	16	43.5
4	07/21/2001	1	43.0
5	07/18/2001	11	41.6
6	07/20/2001	23	40.9
7	07/30/2001	15	38.3
8	07/22/2001	1	35.1
9	08/01/2001	7	34.6
10	07/17/2001	20	34.1**

\* This value was also recorded during one or more hours later in the day.

\*\* This value was also recorded on one or more days later in the reported period.

**PM2.5 TEOM**  
10 Highest Daily 1-Hour Average Maximum Concentrations  
Mayville Visibility Study

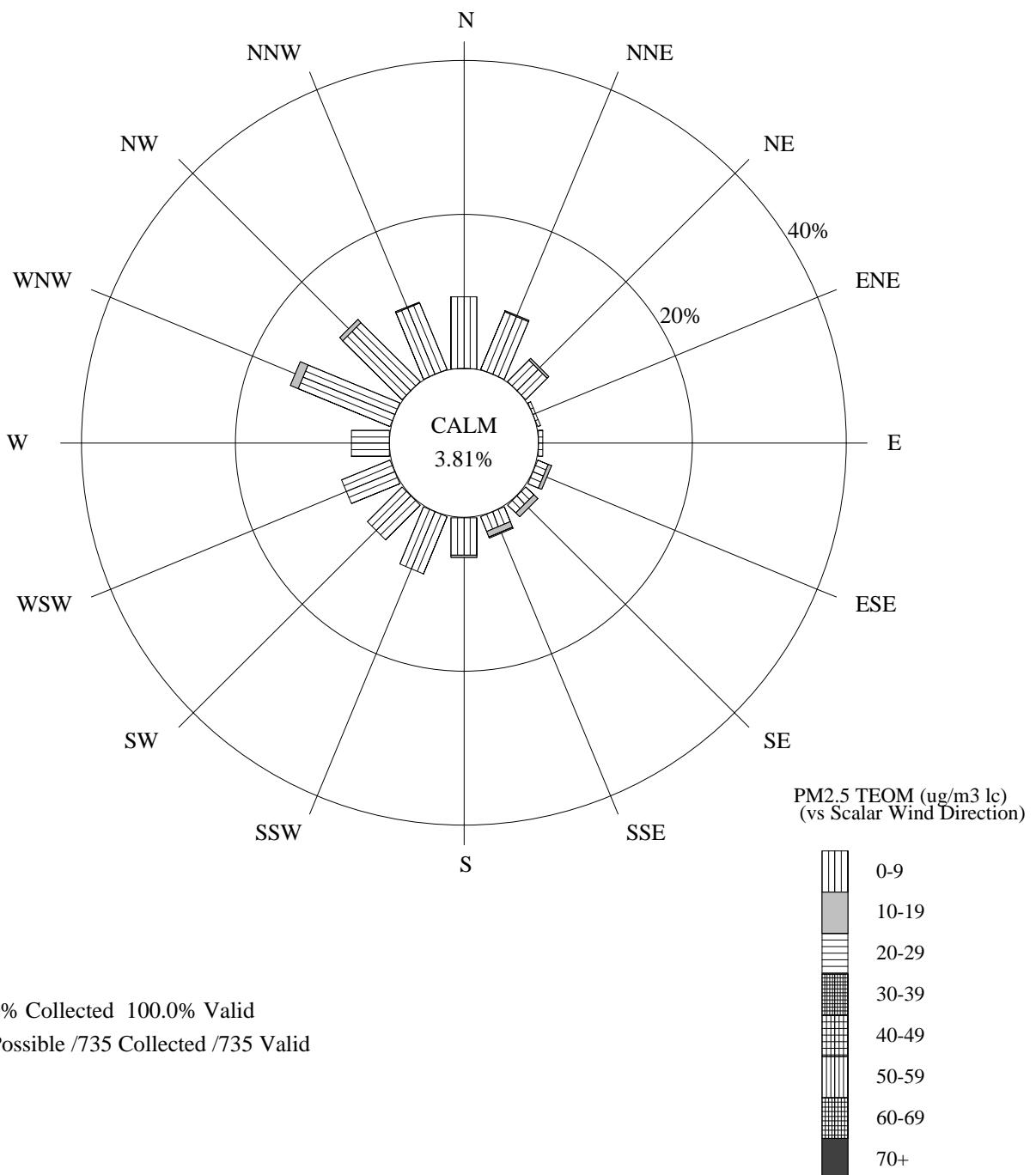
Final Validation  
10/01/2001 - 12/31/2001

Value	Date	Hour	Concentration (ug/m <sup>3</sup> lc)
PM2.5 TEOM			
1	10/28/2001	16	34.7
2	11/17/2001	16	22.8
3	11/14/2001	20	22.6
4	11/15/2001	9	22.5
5	12/21/2001	6	21.1
6	11/07/2001	19	20.2
7	11/01/2001	7	19.7
8	10/02/2001	14	19.4
9	12/11/2001	19	19.1
10	10/03/2001	10	19.0

Mayville Visibility Study

PM2.5 TEOM Pollutant Rose

12/01/2000 - 12/31/2000

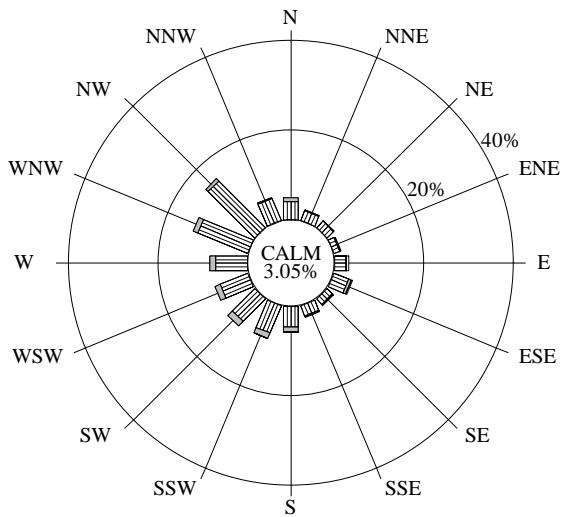


Mayville Visibility Study

Quarterly PM<sub>2.5</sub> TEOM  
Pollutant Rose

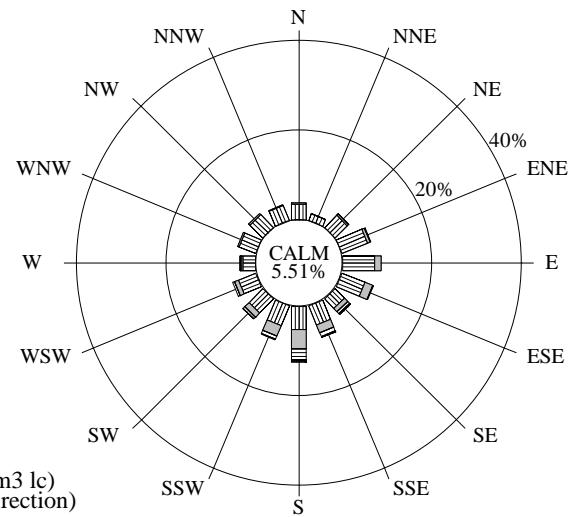
2001

FIRST QUARTER (JAN-MAR)



98.1% Collected 97.0% Valid  
2160 Possible /2118 Collected /2096 Valid

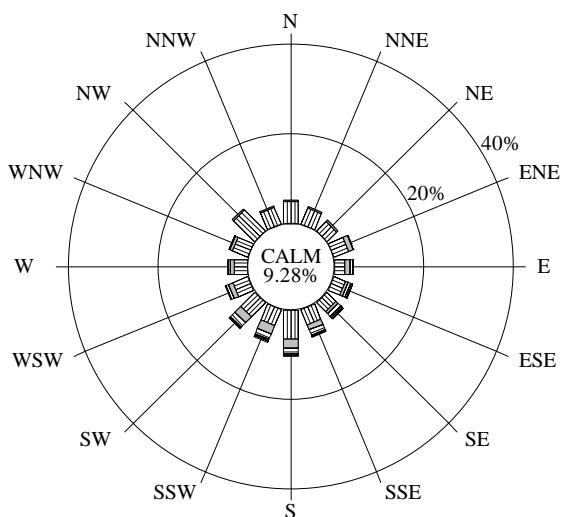
SECOND QUARTER (APR-JUN)



PM<sub>2.5</sub> TEOM (ug/m<sup>3</sup> lc)  
(vs Scalar Wind Direction)

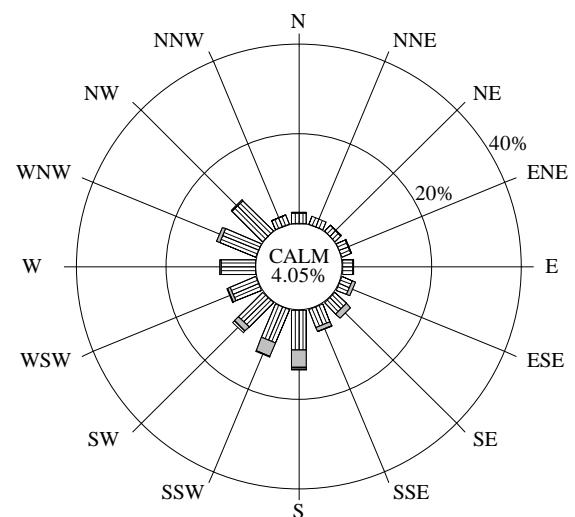
97.0% Collected 95.6% Valid  
2184 Possible /2119 Collected /2087 Valid

THIRD QUARTER (JUL-SEP)



100.0% Collected 97.1% Valid  
2208 Possible /2207 Collected /2145 Valid

FOURTH QUARTER (OCT-DEC)

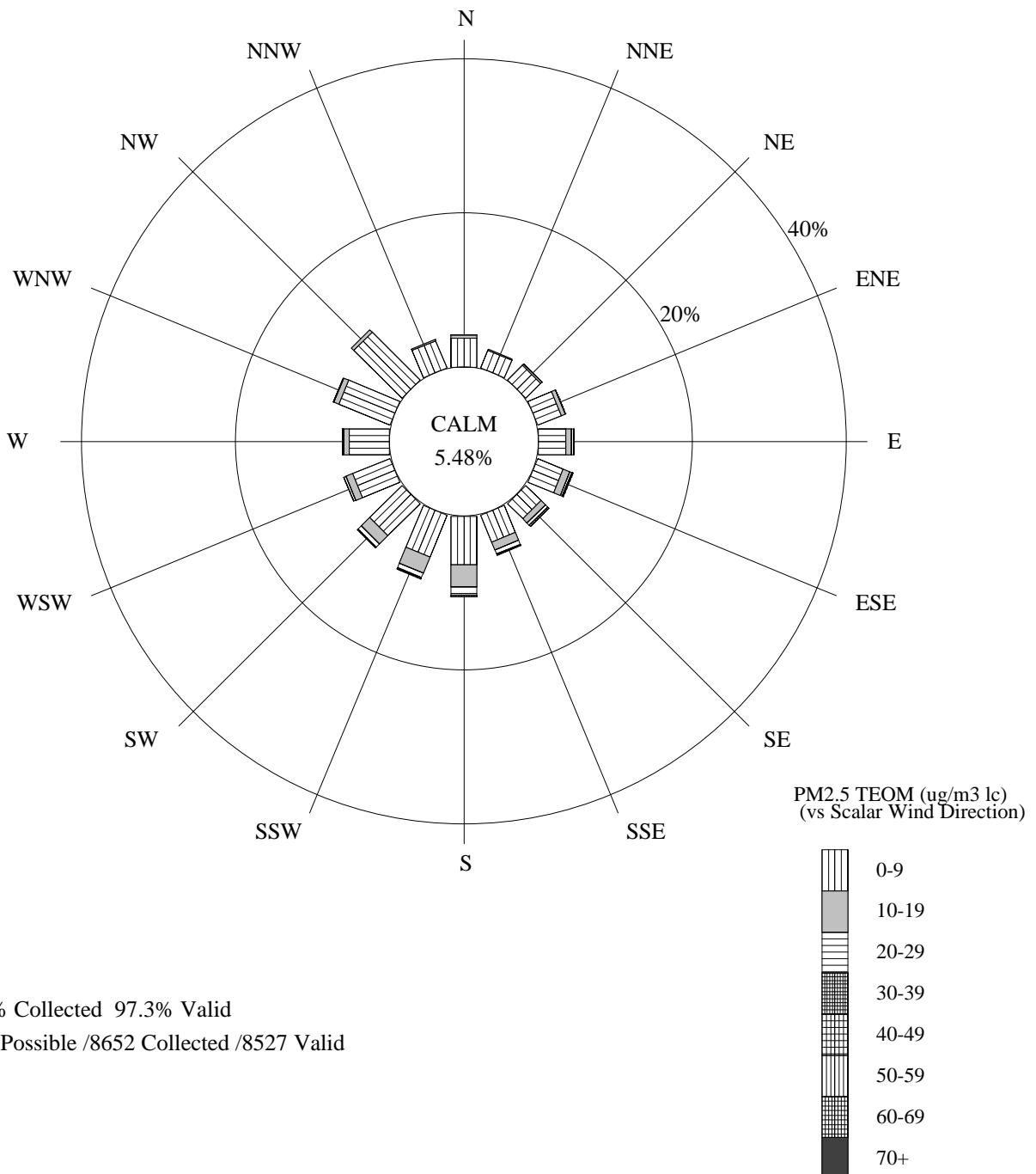


100.0% Collected 99.6% Valid  
2208 Possible /2208 Collected /2199 Valid

Mayville Visibility Study

Annual PM2.5 TEOM  
Pollutant Rose

2001



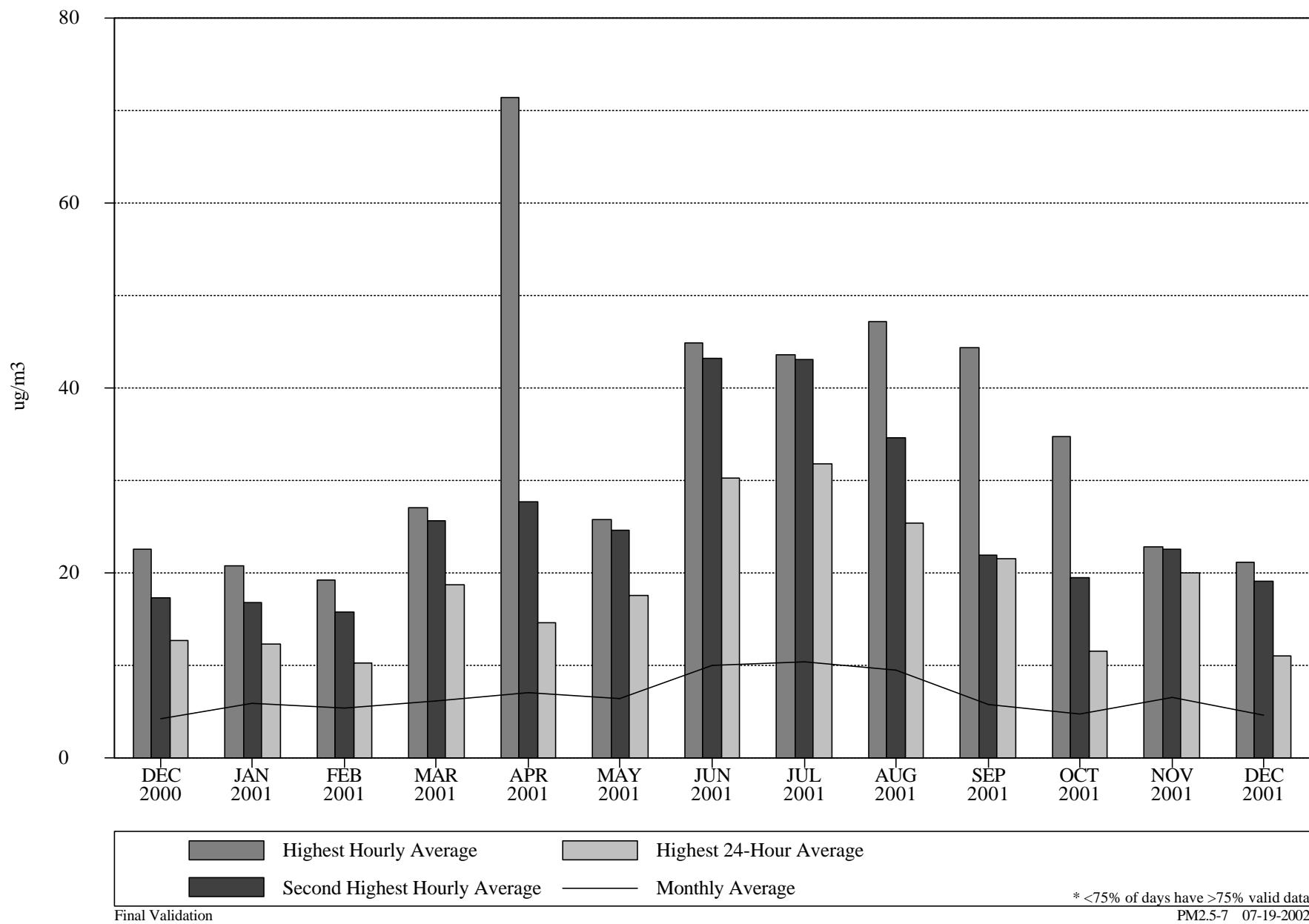
Final Validation

07-30-2002

Mayville Visibility Study

PM2.5 Data Summary by Month  
December 2000 to December 2001

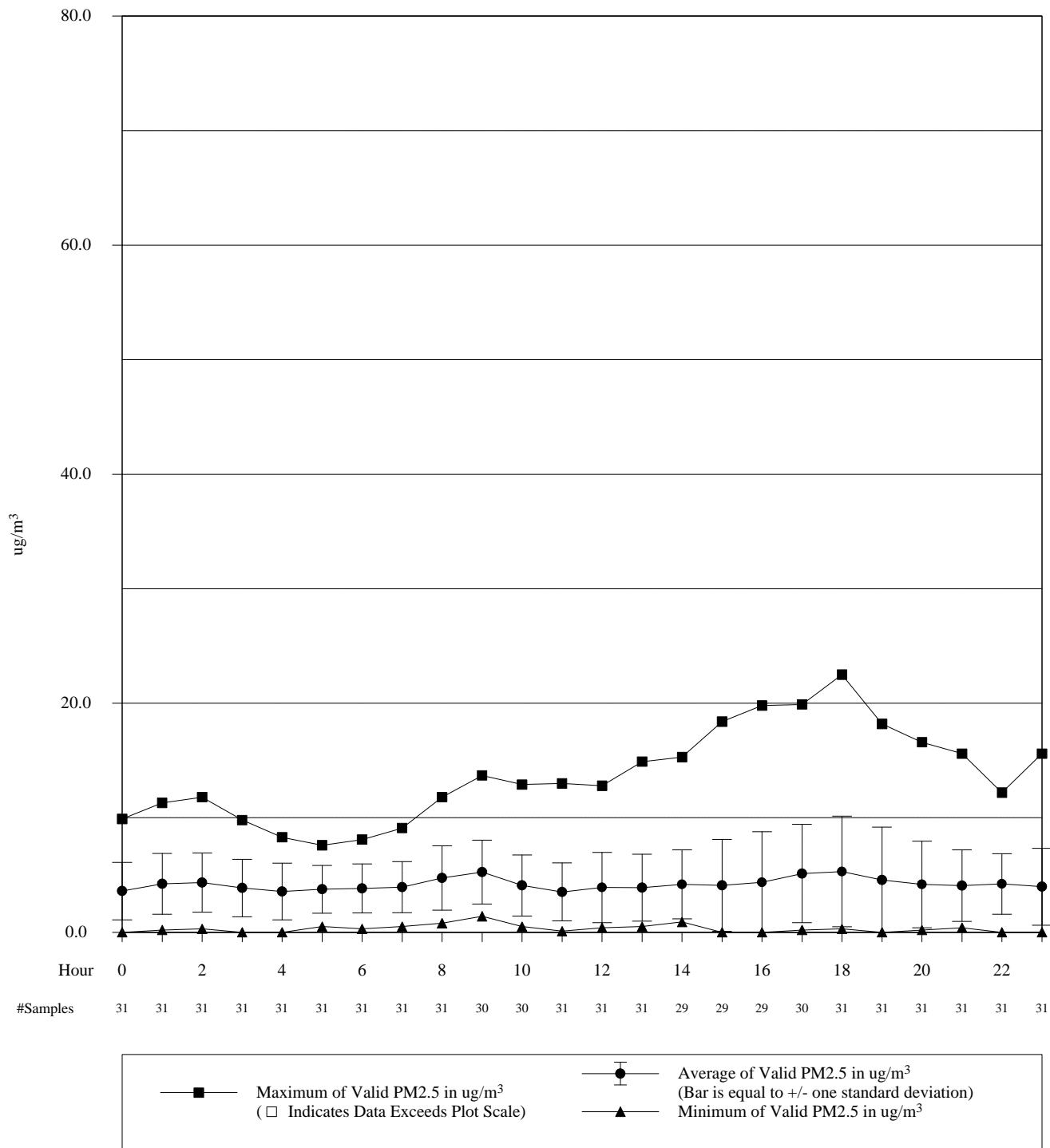
12/01/2000 - 12/31/2001



## Mayville Visibility Study

## Diurnal PM2.5 Plot

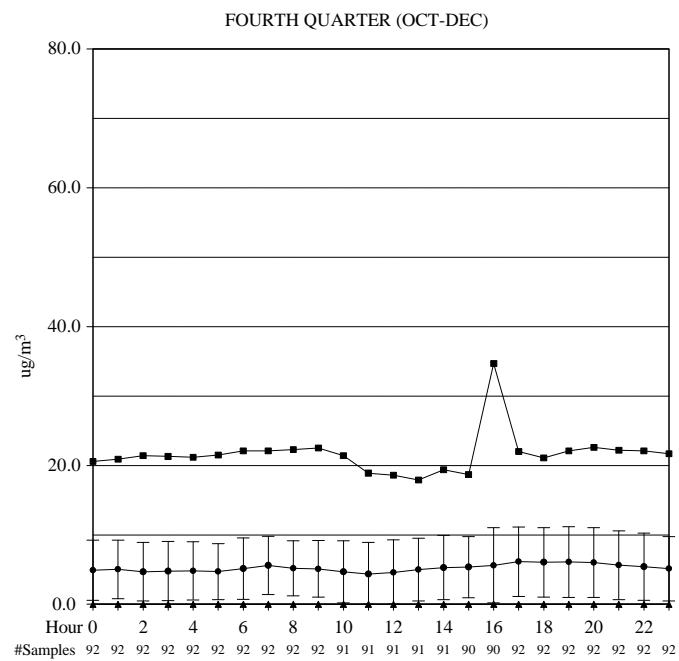
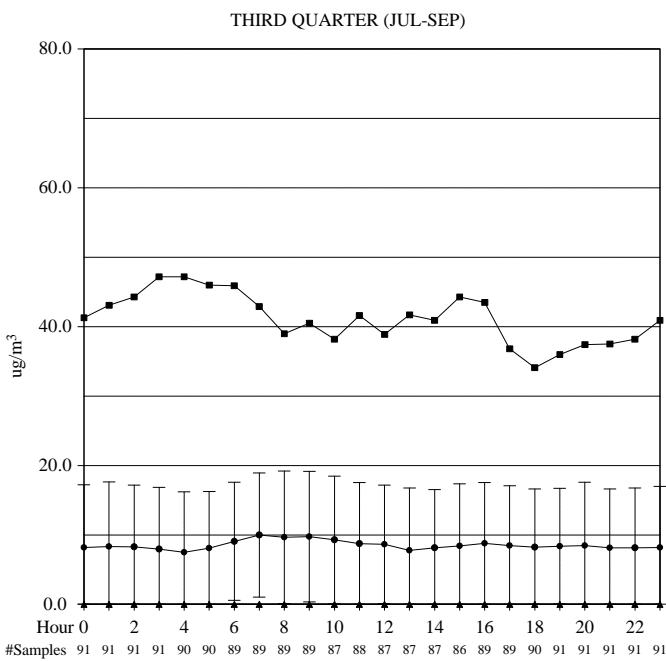
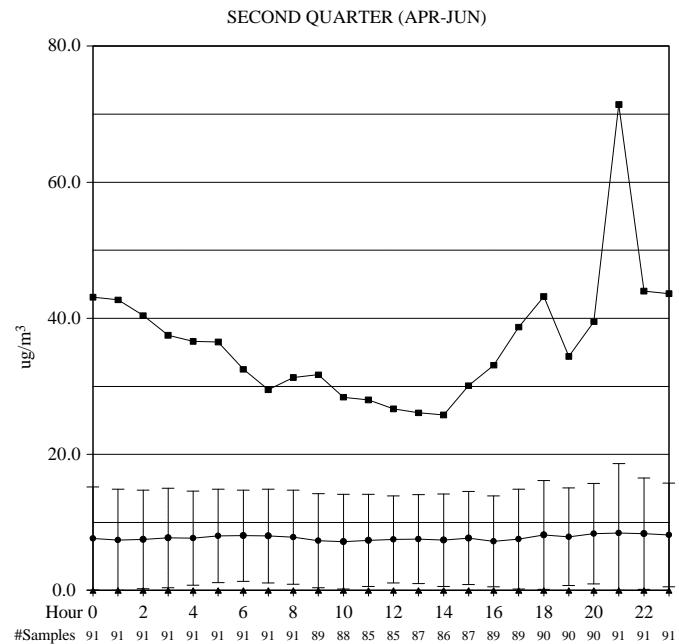
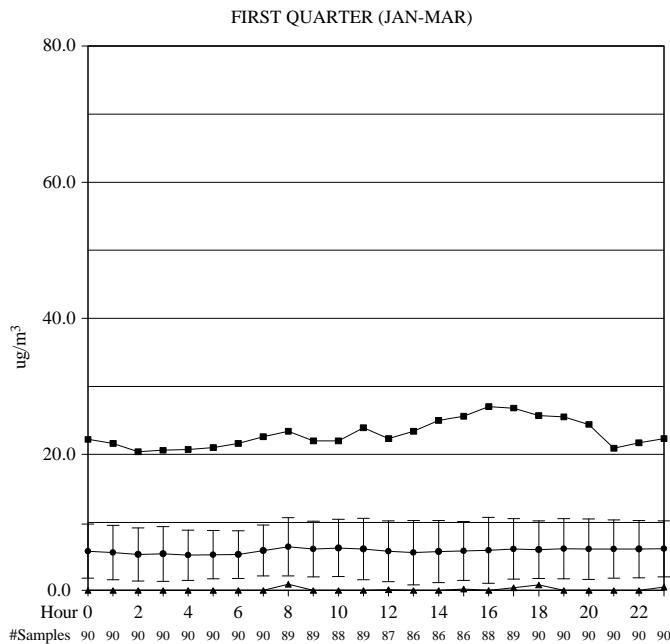
12/01/2000 - 12/31/2000



# Mayville Visibility Study

## Quarterly Diurnal PM2.5 Plots

2001



—■— Maximum of Valid PM2.5 in ug/m <sup>3</sup>	—±— Average of Valid PM2.5 in ug/m <sup>3</sup> (Bar is equal to +/- one standard deviation)
□ Indicates Data Exceeds Plot Scale	—▲— Minimum of Valid PM2.5 in ug/m <sup>3</sup>

